RECYCLED AGGREGATE STUDY
CITY OF EDMONTON

Report

to

Construction, Renovation and Demolition (CRD)
Waste Reduction Advisory Committee
&

Alberta Environment

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1. INTRODUCTION

Thurber Engineering Ltd. (Thurber) was initially retained by Alberta Environment to provide technical input to their Construction, Renovation and Demolition (CRD) Waste Reduction Advisory Committee (WRAC) with respect to the use of recycled aggregates within the province of Alberta. The results of this study, which was presented in our January 21, 2001 report entitled "Market Development Study For Recycled Aggregate Products", concluded that recycled aggregates were being used very successfully by the City of Edmonton (City) as a base course material for their pavements and sidewalks. The report also concluded, however, that there was little hard data quantifying the performance of these pavements.

It was subsequently agreed that the City would construct a series of pavement test sections to compare the performance of pavements built with and without recycled aggregates with comparable sub-grade conditions. The City would be responsible to conduct appropriate testing to characterize the sub-grade conditions at the time of construction, as well as the performance of the different pavement test sections during and after construction. Thurber was retained by Alberta Environment to review the test data and report on the observed performance.

This assignment was conducted as per Thurber's letter of July 11, 2002 to Alberta Environment. The contact person at Alberta Environment has been Ms. Judy Morris. Thurber would also like to acknowledge the support and contributions from Mr. John Mundy, Mr. Al Cepas, P.Eng., Mr. Hugh Donovan, P.Eng., Mr. Dan Dmytryshyn, Mr. Georges Calvez, P.Eng. and Mr. Don Lewycky, P.Eng. of the City of Edmonton and the CRD committee for allowing us to participate in this interesting study

During this study, other test sections were also constructed, however, the scope of this report will focus primarily on the comparison of the two 63 mm aggregate test sections (Sections 2 and 4) and the 20 mm crushed gravel section (Section 1).

2. BACKGROUND

In the Edmonton area, most roadways are constructed using either 20 mm or 25 mm crushed gravel in the base course. The gravel available to the City for construction use has diminished in quantity and quality over the last twenty years while the cost of gravel has increased. As a consequence, the City began to experiment with alternative aggregate sources of gravel for use in road base construction.

In the early 1980's, the City experimented with using recycled aggregates in their pavement structures.

Instead of trucking the concrete and asphalt rubble from demolition projects to the landfill, the material was diverted to a City recycling site. Sources of concrete and asphalt rubble included asphalt street rehabilitation projects, concrete sidewalk replacement programs, asphalt and concrete roadways, excavations from building demolition, as well as material from private contractors such as parking lot reconstruction, etc. This practice has proven to be extremely successful and is now used extensively throughout the City of Edmonton by both City and private construction forces.

The City crushes the concrete and asphalt rubble into the 63 mm aggregate size (termed "63 mm reclaim"). The typical composition is 60% concrete, 25% asphalt and 15% other materials such as soil cement[1], brick, granular and miscellaneous recyclable material.

Information from the City indicates that the 63 mm reclaim has been used in many of the City projects for the past 20 years in lieu of the 20 mm crushed gravel and/or soil cement. Over that period, the City has placed over 3 000 000 tonnes of recycled aggregate or about 175 000 tonnes of reclaim aggregate per year. Example projects within the City which have used this 63 mm reclaim aggregate, include:

- Yellowhead Trail and 50th Street Interchange (1996) - 42 000 tonnes

[1] Soil Cement is a local term for 20 mm crushed gravel blended with 5 percent Portland Cement.

- Anthony Henday from Whitemud Drive to Stony Plain Road (1998) – 207 000 tonnes
- Whitemud Drive East from 34 Street to Highway 14 (1998) 65000 tonnes
- 99 Street Rehabilitation from 67th to 82nd Avenue (2000) 27000 tonnes

In addition to the 63 mm reclaim aggregate; the City produces a 25 mm reclaim aggregate for use below concrete sidewalks. The 25 mm aggregate size was chosen to increase the permeability of the material to facilitate drainage below the sidewalk.

The popularity of these recycled materials has encouraged local contractors to develop their own stockpiles. To date, the author is aware of six other contractors (Standard General, Lafarge, Park Paving, Waiward Excavators, Twin City Excavators and Boulder Concrete), who have started their own stockpiles and crushing operations

3. FIELD PROGRAM

The City has been successful in using the reclaimed aggregate blend over 20 years. There is quality assurance data available in terms of Standard Proctors, gradations and compaction testing, however, there was very little documented performance data available to quantify the performance of the pavements constructed with the 63 mm reclaim aggregate as compared to the natural 63 mm or 20 mm crushed aggregates.

3.1 Test Program

The selected site for the pavement test sections was in the west end of the City on 111 Avenue between 186 Street and Anthony Henday Drive, for a total length of about 1500 metres (see Figure 1). The test sections were constructed between July 2002 and September 2002. The contractor was Standard General Inc. of Edmonton.

The test program developed by the City, consisted of the following:

(a) Three 150-metre long roadway sections with a transition section of at least 10 metres between the sections.

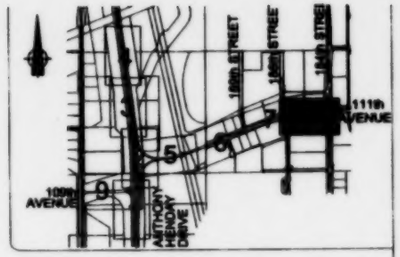
TEST SECTION 5
Sta 0+700 to 0+850
- 50mm ACO (FUTURE OVERLAY)
- 50mm ACO
- 60mm ACB
- 150mm - 3-63 CITY RECLAIMED GRAVEL
- TENSAR BX1200 OR EQUIVALENT
- 150mm CEMENT STABILIZED SUBGRADE
- 600-1500mm SUBBASE CONSTRUCTION (DEPENDANT ON UNDERLYING SOIL CONDITIONS)

TEST SECTION 4
Sta 0+875 to 1+025
- 50mm ACO (FUTURE OVERLAY)
- 50mm ACO
- 60mm ACB
- 325mm - 3-63 CITY RECLAIMED GRAVEL
- 150mm CEMENT STABILIZED SUBGRADE
- 600-1500mm SUBBASE CONSTRUCTION (DEPENDANT ON UNDERLYING SOIL CONDITIONS)

TEST SECTION 3
Sta 1+035 TO 1+180
- 50mm ACO (FUTURE OVERLAY)
- 50mm ACO
- 60mm ACB
- 325mm - 3-63 CITY RECLAIMED GRAVEL
- NON WOVEN GEOTEXTILE
- 150mm CEMENT STABILIZED SUBGRADE (18.3)
- 600-1500mm SUBBASE CONSTRUCTION (DEPENDANT ON UNDERLYING SOIL CONDITIONS)

TEST SECTION 2
Sta 1+220 to 1+370
- 50mm ACO (FUTURE OVERLAY)
- 50mm ACO
- 60mm ACB
- 325mm - CAMERON 63B NATIVE GRAVEL
- 150mm CEMENT STABILIZED SUBGRADE
- 600-1500mm SUBBASE CONSTRUCTION (DEPENDANT ON UNDERLYING SOIL CONDITIONS)

TEST SECTION 1
Sta 1+380 to 1+530
- 50mm ACO (FUTURE OVERLAY)
- 50mm ACO
- 60mm ACB
- 325mm - 3-20 GRAVEL
- 150mm CEMENT STABILIZED SUBGRADE
- 600-1500mm SUBBASE CONSTRUCTION (DEPENDANT ON UNDERLYING SOIL CONDITIONS)



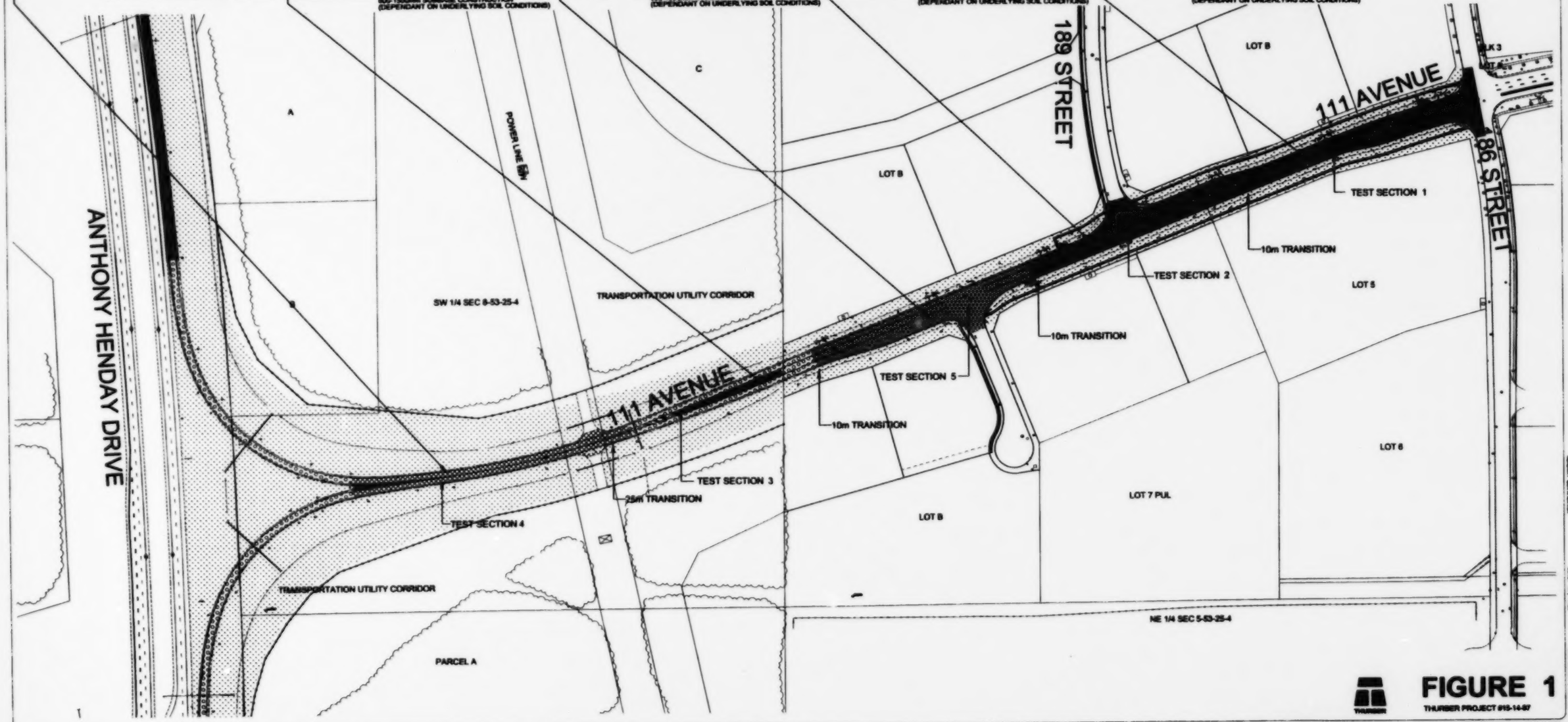


FIGURE 1
THURBER PROJECT #19-14-87

A111 023 D10

NO.	REVISIONS	BY	DATE	APP'D
1	FOR CITY APPROVAL	GPN	2002/05/02	CCB

NO.	ISSUE	BY	DATE
4	TO C.B.I.S.		
3	UNOFFICIAL		
2	AS BUILT		
1	TENDER AWARD		

PROGRAM NO. 1810
TENDER NO. 692275

CONSTRUCTION RETURN
CONTRACTOR
SURVEYOR
DATE
FILE NUMBER
CONSTRUCTION ENGINEER DATE
GENERAL SUPERVISOR DATE

APPROVED FOR CONSTRUCTION
FOR TENDER # 692275

DEPARTMENT / BRANCH	APPROVAL	DATE

DIRECTOR OF ROADWAYS DESIGN DATE
DIRECTOR OF ROADWAYS CONSTRUCTION DATE

SURVEY
JOB NO.
SCALE 1:500
HOR.
VER.

DRAWN D. Lo-Hood, C. Heutzling 2002/05/02
DESIGNED C. Heutzling, D. Lo-Hood 2002/05/02
CHECKED C. Brake 2002/05/02

The City of Edmonton
TRANSPORTATION AND STREETS
STREETS ENGINEERING BRANCH

PROJECT
111 AVENUE CONNECTION TO ANTHONY HENDAY
TEST SECTIONS
DETAIL

DRAWING
A111 023 D10

(b) Subgrade material along each section was tested using the following laboratory tests

- soil classification,
- Atterberg limits,
- California Bearing Ratio (CBR),
- moisture content.

(c) The City undertook Dynaflect testing upon subgrade completion. This testing was carried out at 10 metre intervals in both lanes. Compaction testing of the subgrade using nuclear densometer was also conducted.

(d) The contractor placed and compacted City of Edmonton (COE) Designation 3, Class 63B Natural Gravel in one section; Recycled 3-63B in the second section and 3-20A gravel (i.e., 20 mm crushed natural gravel) in the third section. This material was placed and compacted to 100% of Standard Proctor maximum dry density. Laboratory testing for granular materials consisted of gradation and crushed face counts.

(e) Once the base material had been placed, the City undertook Dynaflect testing at the same spacing as described above.

(f) The asphalt concrete was placed with Dynaflect testing taken after each lift had been placed.

(g) The test sections will be tested with a dynaflect machine twice per year to monitor future performance of the roadway structures.

3.2 Pavement Structures

The project was originally planned to have three test sections (Sections 1, 2 and 4). However, during the course of construction, two additional test sections (Sections 3 and 5) were added. Section 3 required additional depth of cement stabilization and placement of geotextile and Section 5 was added as the City wished to evaluate a pavement section constructed with geogrid. A summary of

the five different pavement structures built within the test section is provided in Table 1.

TABLE 1
SUMMARY OF FIVE PAVEMENT SECTIONS

Section 1 Sta 1+380 to 1+530	50 mm ACO (future overlay) 50 mm ACO 60 mm ACB *325 mm - 3-20 Natural Gravel* *150 mm Cement stabilized subgrade at 10 kg/m^3 cement*
Section 2 Sta 1+220 to 1+370	50 mm ACO (future overlay) 50 mm ACO 60 mm ACB *325 mm - 3-63B Natural Crushed Natural Gravel (Cameron Pit)* *150 mm Cement stabilized subgrade at 10 kg/m^3 cement*
Section 3 Sta 1+035 to 1+160	50 mm ACO (future overlay) 50 mm ACO 60 mm ACB 325 mm - 3-63 Reclaimed Crushed Gravel *Non-woven geotextile (Layfield Plastics LP6)* *300 mm Cement stabilized subgrade at 20 kg/m^3 cement*
Section 4 Sta 0+875 to 1+025	50 mm ACO (future overlay) 50 mm ACO 60 mm ACB *325 mm - 3-63 Reclaimed Crushed Gravel* *150 mm Cement stabilized subgrade at 10 kg/m^3 cement*
Section 5 Sta 0+700 to 0+850	50 mm ACO (future overlay) 50 mm ACO 60 mm ACB 150 mm - 3-63 Reclaimed Crushed Gravel *Biaxial Geogrid (Tensar BX1200)* *150 mm Cement stabilized subgrade at 10 kg/m^3 cement*

Notes:
ACO = Asphalt Concrete Overlay - City of Edmonton 75 Blow Mix
ACB = Asphalt Concrete Base - City of Edmonton 75 Blow Mix

As noted in the above table, the total thickness of asphalt for each section is the same (160 mm, including a future overlay) with differences in the type and thickness of granular base course at each section. The granular base course consisted of 20 mm crushed natural gravel, 63 mm crushed natural gravel and 63 mm crushed reclaimed gravel. Sections 1 to 4 had a total base course thickness of 325 mm while Section 5 had a total base course thickness of 150 mm.

3.3 Construction Observations

Construction observations from Standard General Inc. personnel in the field are summarized below:

- The 63 mm reclaim aggregate compacts well and is easy to work with.
- Although the 63 mm reclaim aggregate looks coarse (i.e., lacking in fines), they were able to pave over top of the 63 mm reclaim aggregate without having to place a lift of smaller aggregate material (i.e., 20 mm crushed gravel). The contractor indicates that this material has a relatively smooth and tight surface after compacting.
- The surface of the 63 mm reclaim "tightens up" after packing allowing it to shed water. Standard General Inc. personnel indicate that they have never lost a subgrade due to rain over the nine to ten year period they have been using this material provided the 63 mm reclaim aggregate has been placed and compacted.
- For the same thickness, the 63 mm reclaim aggregate bridges soft subgrade better than the natural 63 mm aggregate. Standard General's opinion is the better bridging ability comes from the 100 percent fractured faces of the material and possibly the presence of residual cement fines in the reclaim aggregate which may be hydrating.

Comments from the City of Edmonton

- The demand for the 63 mm reclaim aggregate is high and the City cannot produce enough product to keep up with demand. The popularity of this product has resulted in startup of private sector companies in aggregate recycling.
- Discussions with Mr. Hugh Donovan, P.Eng., Construction Services Engineer of the City of Edmonton indicated that there have been no roadway failures to date with roads constructed with the reclaim gravel.

- The City in their pavement designs use the same equivalency factors for the 63 mm reclaim material as the 20 mm crushed gravel (i.e., 1 mm asphalt = 2 mm of 63 mm reclaim gravel = 2 mm 20 mm crushed gravel).

4. DATA COLLECTION

4.1 Geotechnical Information

Based on information provided to us by the City, the subsurface soil conditions consisted of medium plastic silty clay. A summary of the laboratory testing conducted by the City is provided in Appendix A and summarized in Table 2.

TABLE 2
SUMMARY OF GEOTECHNICAL LABORATORY TESTING

SECTION	MOISTURE (%)	ATTERBERG LIMITS			GRADATION (%)			CBR (%)		
		L.L.	P.L.	P.I.	SAND	SILT	CLAY	M.C.	UNSOAKED	SOAKED
1-1	25.8	63	29	34	6	46	48			
1-2	26.5	46	26	21	3	49	48			
1-3	26.0	60	28	31	6	49	45			
1-3								26	9.2	6.0
2-1								20	13.0	4.0
2-1	20.4	51	24	27	5	57	38			
2-3								25	4.5	6.0
2-3		54	28	26	6	50	44			
3-1								22	3.7	7.9
3-1		48	18	30	6	58	36			
3-2		37	23	14	10	61	29			
3-3	22.4							22.4	6.0	5.5
3-3		43	24	19	11	53	36			
4-2								22.2	4.2	6.1
4-2		53	29	24	2	52	46			
4-3								20	12.5	3.0
4-3		54	28	26	3	47	50			

Notes: L.L. = Liquid Limit, P.L. = Plastic Limit, P.I. = Plastic Index, M.C. = Moisture Content
CBR = California Bearing Ratio

4.2 Field Materials Testing

During construction, the City conducted field monitoring consisting of compaction testing, gradations and Standard Proctors. Samples of material for Standard Proctor analysis were obtained from the cement stabilized clay and the various gravels (i.e., 20 mm crush, 63 mm crush and 63 mm Recycled Aggregate).

Standard Proctors conducted on the subgrade materials are summarized on Table 3.

TABLE 3
SUMMARY OF STANDARD PROCTORS

LOCATION	SOIL TYPE	OPTIMUM MOISTURE CONTENT (%)	MAXIMUM DRY DENSITY (kg/m^3)
Sta. 1+461 @ grade	Cement stabilized clay	24	1586
Sta. 1+510 @ grade	Cement stabilized clay	24	1581
Sta. 1+410 @ grade	Cement stabilized clay	24	1563
Sta. 1+410 @ grade	20 mm crushed gravel	7	2149
Sta. 1+288 @ grade	Cement stabilized clay	24	1598
Sta. 1+236 @ grade	Cement stabilized clay	23	1625
Sta. 1+288 @ grade	63 mm crushed gravel	10	2060
Sta. 1+165 @ grade	Cement stabilized clay	22	1641
Sta. 1+080 @ grade	Cement stabilized clay	22	1649
Sta. 1+190 @ grade	63 mm recycled aggregate	10	1955
Sta. 0+938 @ grade	Cement stabilized clay	26	1513
Sta. 0+884 @ grade	Cement stabilized clay	26	1510
Sta. 0+972 @ grade	63 mm recycled aggregate	10	1955
Sta. 1+020 @ grade	Cement stabilized clay	26	1536
Sta. 0+763 @ grade	Cement stabilized clay	25	1577
Sta. 0+720 @ grade	Cement stabilized clay	22	1600
Sta. 0+762 @ grade	63 mm recycled aggregate	10	1955

The City of Edmonton project specifications call for a required compaction of 100 percent of Standard Proctor Maximum Dry Density (SPMDD) for both the clay subgrade and the granular base course. The test results provided by the City indicate that these requirements were met. These results are provided in Appendix B.

City of Edmonton gradation limits for the 20 mm crushed gravel, 63 mm crushed gravel and the 63 mm reclaimed gravel are shown in Table 4.

TABLE 4
CITY OF EDMONTON GRADATION LIMITS

SIEVE SIZE	DES. 3 CLASS 20A (20 mm CRUSH)	DES. 3 CLASS 63B (63 mm NATURAL & RECLAIM)
80 mm		
63 mm		100
25 mm		55-75
20 mm	100	
12.5 mm	60-92	40-60
5 mm	37-62	20-45
2 mm	26-44	
1.25 mm		14-33
400 µm	12-27	
315 µm		7-22
160 µm	7-18	
80 µm	2-10	0-10
Min. Percent Crush Faces	60 (2 face)	75 (2 face)

Copies of gradation analyses conducted on each of the aggregate types are presented in Appendix B The test results show that the supplied aggregate samples met the required gradation limits.

4.3 Dynaflect Testing

The City using a Dynaflect machine undertook strength testing of the subgrade, base course and asphalt surface course. The Dynaflect machine is a pavement strength measuring apparatus which measures the dynamic deflection of a pavement structure using an oscillatory load. This apparatus is used by the City to obtain pavement deflection readings for input into their pavement management system.

The averaged Dynaflect test results from each stage of construction are summarized in the following table and also in Figures 2 and 3.

TABLE 5
SUMMARY OF AVERAGED DYNAFLECT TEST RESULTS

	Section 1 20 mm Crush (mils)		Section 2 63 mm Natural (mils)		Section 4 63 mm Reclaim (mils)	
	EB	**WB**	**EB**	**WB**	**EB**	**WB**
Subgrade	2.22	2.15	2.69	2.43	2.35	2.36
Base Course	1.76	1.76	1.78	1.60	1.49	1.53
First Lift ACP	1.64	1.59	1.16	1.21	1.05	1.04
Second Lift ACP	1.18	1.18	0.98	0.92	0.86	0.89

4.3.1 Subgrade Dynaflect Results

The results of the subgrade testing for both lanes indicate average deflections of 2.19 mils in Section 1, 2.56 mils in Section 2 (natural 63 mm aggregate) and 2.36 mils in Section 4 (reclaim 63 mm aggregate). The range in the deflections was likely due to the variability of the subgrade soils.

It should be noted that during construction, the subject roadway sections were cement stabilized to a depth of 150 mm with a cement application rate of 10 kg/m^2. Cement stabilization is a routine construction procedure for the City and is conducted to assist in drying wet subgrade and to reduce the swelling potential of clay subgrade.

4.3.2 Granular Base Course Dynaflect Results

The average deflections in the granular base course were 1.76 mils in Section 1, 1.69 mils in Section 2 and 1.51 mils in Section 4.

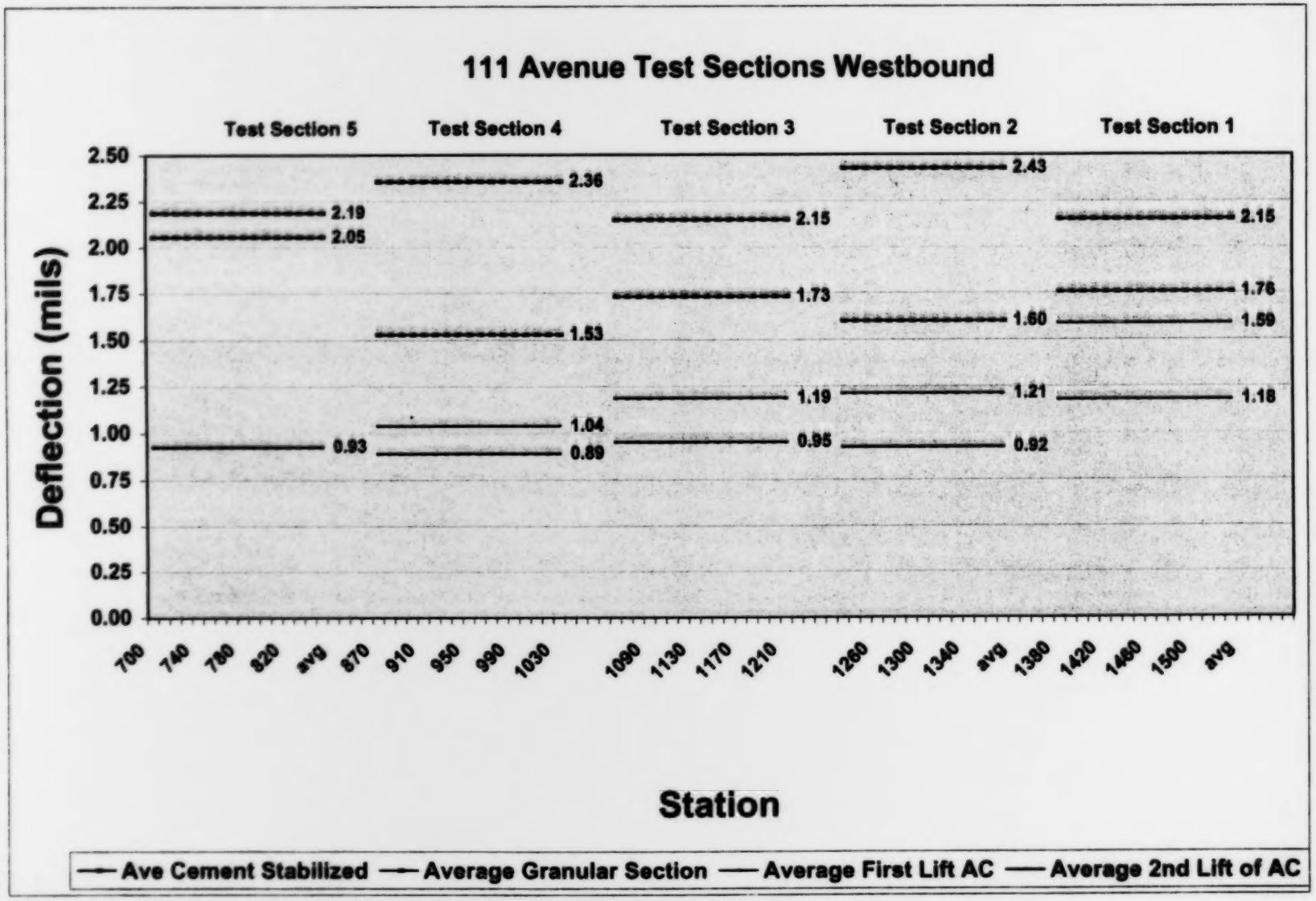

111 Avenue Test Sections Westbound
Test Section 5
Test Section 4
Test Section 3
Test Section 2
Test Section 1
Deflection (mils)
2.50
2.25
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
2.19
2.05
0.93
2.36
1.53
1.04
0.89
2.15
1.73
1.19
0.95
2.43
1.60
1.21
0.92
2.15
1.76
1.59
1.18
700
740
780
820
avg
870
910
950
990
1030
1090
1130
1170
1210
1260
1300
1340
avg
1380
1420
1460
1500
avg
Station
Ave Cement Stabilized
Average Granular Section
Average First Lift AC
Average 2nd Lift of AC

FIGURE 2

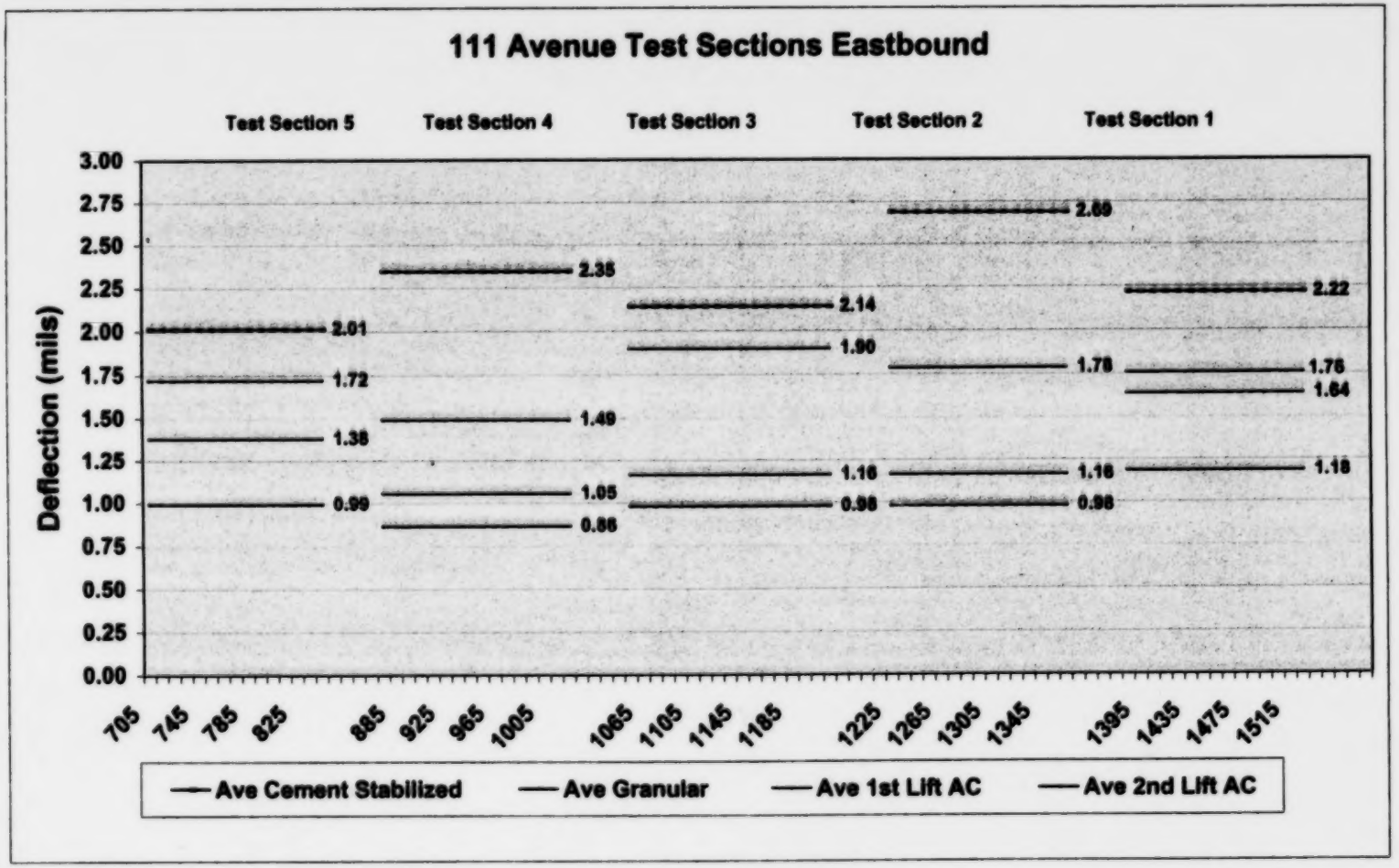

111 Avenue Test Sections Eastbound
Test Section 5
Test Section 4
Test Section 3
Test Section 2
Test Section 1
Deflection (mils)
3.00
2.75
2.50
2.25
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
2.01
1.72
1.38
0.99
2.35
1.49
1.05
0.86
2.14
1.90
1.18
0.98
2.69
1.78
1.18
0.98
2.22
1.76
1.64
1.18
705
745
785
825
885
925
965
1005
1065
1105
1145
1185
1225
1265
1305
1345
1395
1435
1475
1515
Ave Cement Stabilized
Ave Granular
Ave 1st Lift AC
Ave 2nd Lift AC

FIGURE 3

The deflections obtained in Section 4 (containing the 63 mm reclaim gravel) were 17% lower than Section 1 (20 mm crushed gravel) and 11% lower than Section 2 (63 mm natural aggregate).

4.3.3 Asphalt Concrete Dynaflect Results

The initial results of the Dynaflect testing from the first and second lifts of asphalt show the 63 mm reclaim aggregate with significantly lower deflections than either the 63 mm natural or the 20 mm crushed gravel.

It should be noted that Dynaflect testing was conducted within one to two days following the paving for each lift.

As shown in Table 5 the following observations are noted:

Observations Following First Lift of ACP

- Section 4 (63 mm reclaim) shows 35% lower deflection than Section 1 (20 mm crush).
- Section 4 (63 mm reclaim) shows 12% lower deflection than Section 2 (63 mm natural).

Observations Following Second Lift of ACP

- Section 4 (63 mm reclaim) shows 25% lower deflection than Section 1 (20 mm crush).
- Section 4 (63 mm reclaim) shows 7% lower deflection than Section 2 (63 mm natural).

5. MATERIAL COSTS

Aggregate costs for this material as supplied by the City and three other contractors (Standard General Inc., Lafarge Canada Inc. and Park Paving Ltd.) are summarized in Table 3.

TABLE 3
AGGREGATE COSTS INCLUDING DELIVERY TO THE PROJECT

SUPPLIER	20 mm Crushed Gravel (Des 3-20)	63 mm Natural Crushed Gravel (Des 3-63)	63 mm Reclaim Crushed Aggregate (Des 3-63)
City of Edmonton	N/A	N/A	$6.00/tonne
Standard General Inc.	$12.25/tonne	$12.05/tonne	$13.00/tonne
Lafarge Canada Inc.	$13.46/tonne	$16.40/tonne	$16.40/tonne
Park Paving Ltd.	$12.25/tonne	$12.05/tonne	$14.00/tonne

6. OBSERVATIONS

Based on the above information, our observations from this study are as follows:

(a) Based on contractor and City observations, the 63 mm reclaim has better "bridging" ability than the equivalent thickness of 20 mm crushed gravel or 63 mm natural gravel. This may be explained as the 63 mm reclaim aggregate material has almost 100 percent crushed faces. In addition, due to the 100 percent crushed faces, the friction angle (or aggregate interlock) of the 63 mm reclaim is estimated to be about 45° (similarly to railway ballast) whereas the friction angle of the 63 mm natural aggregate is estimated to be around 38°.

(b) A surprising observation was the deflection values measured by the Dynaflect machine for the 20 mm natural crushed gravel section were higher than both the reclaim 63 mm aggregate section and the natural 63 mm aggregate section.

It should be noted that 20 mm crushed gravel has historically been considered a better aggregate product than both the natural 63 mm aggregate and the reclaim 63 mm aggregate.

(c) The roadway section containing the 63 mm reclaim aggregate performed better than the other roadway sections (as measured by Dynaflect testing). This was especially apparent for all Dynaflect testing from the base course onwards.

(d) The Dynaflect deflections were converted to their equivalent Benkelman Beam Representative Rebound Deflections. Figure IV-6 from the design manual titled, *Asphalt Overlays For Highway and Street Rehabilitation, Manual Series* 17, June 1983 was used to determine the required asphalt overlay thickness to achieve 1 000 000 Equivalent Single Axle Loads (ESAL) based on a Benkelman Beam Representative Rebound Deflection. A million ESALs is the approximate traffic volume for a major arterial roadway (with two bus routes) in the City of Edmonton for a 20 year design period. This information has been summarized in Table 6.

TABLE 6
ASPHALT OVERLAY THICKNESS REQUIREMENTS
FROM BENKALMAN BEAM DESIGN REBOUND DEFLECTIONS
(REF: ASPHALT INSTITUTE MS-17, FIGURE IV-6)

Section No.	Benkelman Beam Design Rebound Deflection(mm)	Required Overlay Thickness to Achieve $1x10^6$ ESALs
1 - 20 mm Crush	1.06	40 mm
2 - 63 mm Natural	0.87	none required
4 - 63 mm Reclaim	0.84	none required

Note:
1. Benkelman Beam Design Rebound Deflection values (mean plus 2 standard deviations) were obtained by converting the deflection values obtained from dynaflect testing to equivalent Benkelman Beam readings. The formula used for this conversion was developed by Tom Christison of the Alberta Research Council in conjunction with Alberta Transportation.
2. The design rebound deflections were adjusted for seasonal and temperature corrections.

As noted in Table 6, there is no overlay requirement for Sections 2 and 4 (both the natural and reclaim 63 mm aggregates) and a 40 mm thick overlay is required for Section 1 (the 20 mm natural crushed gravel). The design of these roadway sections incorporate an final asphalt overlay lift of 50 mm in about two years (2004). It should be noted that the required overlay thickness of the roadway is dependent upon future traffic and other factors such as construction quality, maintenance, smoothness, etc.

7. CONCLUSION

The results of this study indicate that the roadway sections constructed using the reclaim 63 mm aggregate performed as well as the roadway section constructed with the natural 63 mm aggregate and better than the roadway section constructed with the 20 mm natural crushed aggregate.

Over the City's 20 year history using this material, it has been shown that the 63 mm reclaim has been very effective bridging soft subgrade. This has been reflected in comments from contractors who have used this material and have started to produce and create their own reclaim aggregate stockpiles.

The City has noted that the material produced for themselves has proven to be cost effective (reference Table 3).

Prior to this study the City allowed the following equivalencies in pavement design:

- 1 mm Asphalt = 2 mm of 20 mm crush = 2 mm of 63 mm reclaim

The limited information from this test section suggests that the equivalency could be reviewed for the 63 mm reclaim potentially allowing for thinner pavement sections built using the 63 mm reclaim.

It should also be noted that prior to reusing asphalt and concrete rubble as reclaimed aggregate in road base, the material would have been sent to the local landfills incurring the associated costs of landfill operations in terms of space and tipping fees.

INTERPRETATION OF THE REPORT *(continued)*

b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to us. We have relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, we cannot accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of persons providing information.

6. RISK LIMITATION

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause an accidental release of those substances. In consideration of the provision of the services by us, which are for the Client's benefit, the Client agrees to hold harmless and to indemnify and defend us and our directors, officers, servants, agents, employees, workmen and contractors (hereinafter referred to as the "Company") from and against any and all claims, losses, damages, demands, disputes, liability and legal investigative costs of defence, whether for personal injury including death, or any other loss whatsoever, regardless of any action or omission on the part of the Company, that result from an accidental release of pollutants or hazardous substances occurring as a result of carrying out this Project. This indemnification shall extend to all Claims brought or threatened against the Company under any federal or provincial statute as a result of conducting work on this Project. In addition to the above indemnification, the Client further agrees not to bring any claims against the Company in connection with any of the aforementioned causes.

7. SERVICES OF SUBCONSULTANTS AND CONTRACTORS

The conduct of engineering and environmental studies frequently requires hiring the services of individuals and companies with special expertise and/or services which we do not provide. We may arrange the hiring of these services as a convenience to our Clients. As these services are for the Clients' benefit, the Client agrees to hold the Company harmless and to indemnify and defend us from and against all claims arising through such hirings to the extent that the Client would incur had he hired those services directly. This includes responsibility for payment for services rendered and pursuit of damages for errors, omissions or negligence by those parties in carrying out their work. In particular, these conditions apply to the use of drilling, excavation and laboratory testing services.

8. CONTROL OF WORK AND JOBSITE SAFETY

We are responsible only for the activities of our employees on the jobsite. The presence of our personnel on the site shall not be construed in any way to relieve the Client or any contractors on site from their responsibilities for site safety. The Client acknowledges that he, his representatives, contractors or others retain control of the site and that we never occupy a position of control of the site. The Client undertakes to inform us of all hazardous conditions, or other relevant conditions of which the Client is aware. The Client also recognizes that our activities may uncover previously unknown hazardous conditions or materials and that such a discovery may result in the necessity to undertake emergency procedures to protect our employees as well as the public at large and the environment in general. These procedures may well involve additional costs outside of any budgets previously agreed to. The Client agrees to pay us for any expenses incurred as the result of such discoveries and to compensate us through payment of additional fees and expenses for time spent by us to deal with the consequences of such discoveries. The Client also acknowledges that in some cases the discovery of hazardous conditions and materials will require that certain regulatory bodies be informed and the Client agrees that notification to such bodies by us will not be a cause of action or dispute.

9. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on our interpretation of conditions revealed through limited investigation conducted within a defined scope of services. We cannot accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes decisions made to either purchase or sell land.

STATEMENT OF GENERAL CONDITIONS

1. STANDARD OF CARE

This study and Report have been prepared in accordance with generally accepted engineering or environmental consulting practices in this area. No other warranty, expressed or implied, is made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report which is of a summary nature and is not intended to stand alone without reference to the instructions given to us by the Client, communications between us and the Client, and to any other reports, writings, proposals or documents prepared by us for the Client relative to the specific site described herein, all of which constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. WE CANNOT BE RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purpose that were described to us by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the document are only valid to the extent that there has been no material alteration to or variation from any of the said descriptions provided to us unless we are specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT OUR WRITTEN CONSENT. WE WILL CONSENT TO ANY REASONABLE REQUEST BY THE CLIENT TO APPROVE THE USE OF THIS REPORT BY OTHER PARTIES AS "APPROVED USERS". The contents of the Report remain our copyright property and we authorize only the Client and Approved Users to make copies of the Report only in such quantities as are reasonably necessary for the use of the Report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make the Report, or any portion thereof, available to any party without our written permission. Any use which a third party makes of the Report, or any portion of the Report, are the sole responsibility of such third parties. We accept no responsibility for damages suffered by any third party resulting from unauthorized use of the Report.

5. INTERPRETATION OF THE REPORT

a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgemental in nature and even comprehensive sampling and testing programs, implemented with the appropriate equipment by experienced personnel, may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and all persons making use of such documents or records should be aware of, and accept, this risk. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

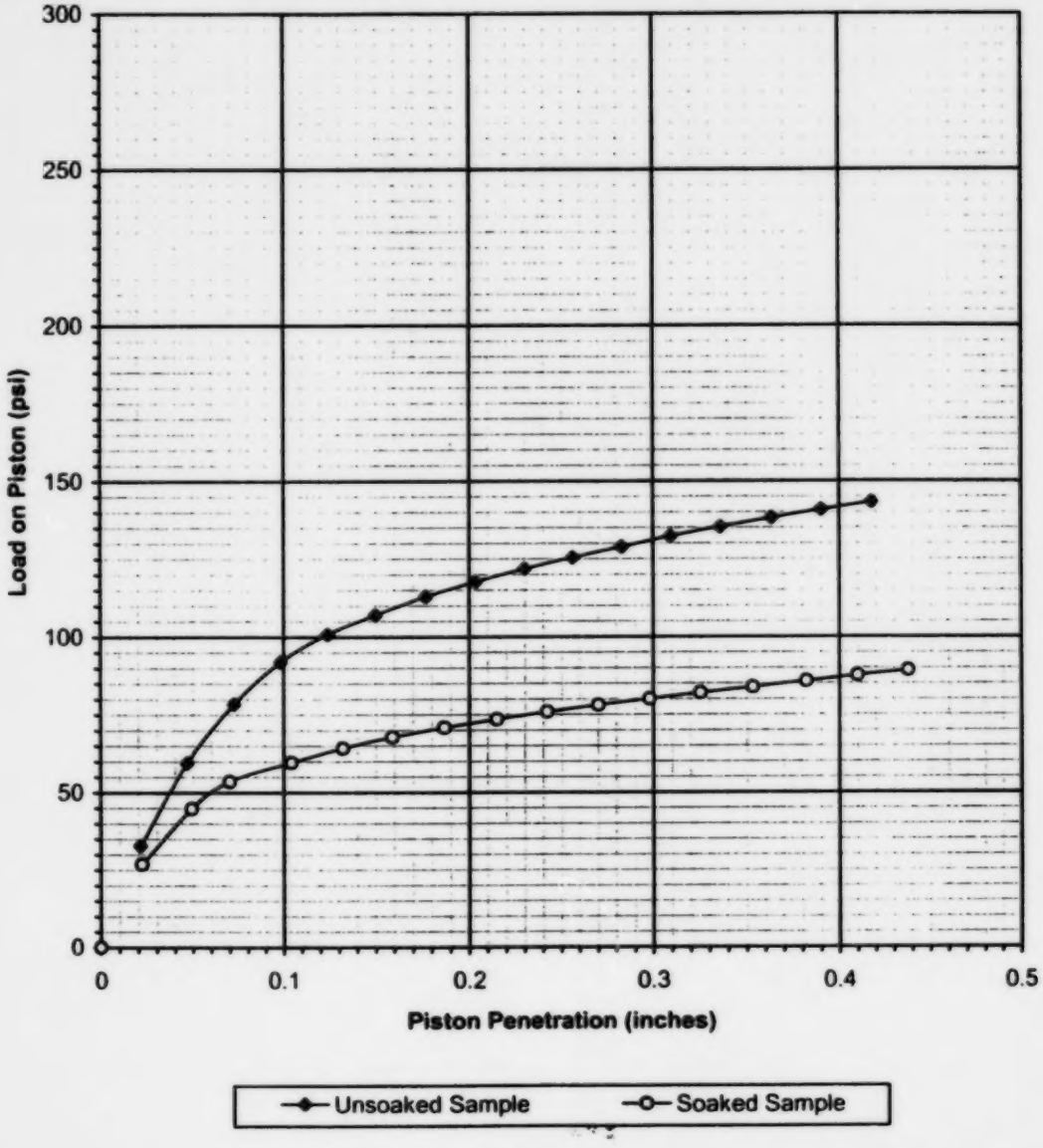
(see over...)

APPENDIX A

APPENDIX A

Geotechnical Laboratory Test Results

CALIFORNIA BEARING RATIO



Ref. ASTM D1833		UNSOAKED	SOAKED
CORRECTED 0.1" PENETRATION (psi)		92	60
CORRECTED 0.2" PENETRATION (psi)		117	73
CALIFORNIA BEARING RATIO		9.2	6.0
MOISTURE CONTENT (%)	TOP 3 cm	25.7	31.5
	MIDDLE		26.2
	BOTTOM 3cm		25.0
SURCHARGE WEIGHT = 25.9 kg		PERCENT SWELL = 0.5	
AVERAGE DRY DENSITY = 1513 kg/m^3 at 26 % M.C.			

THE CITY OF Edmonton ENGINEERING SERVICES PUBLIC WORKS

Test section 1-3
111 Ave. - 184 St.

TEST HOLE NO:

DEPTH (m):

DATE TESTED: 02-10-04

FIGURE NO.

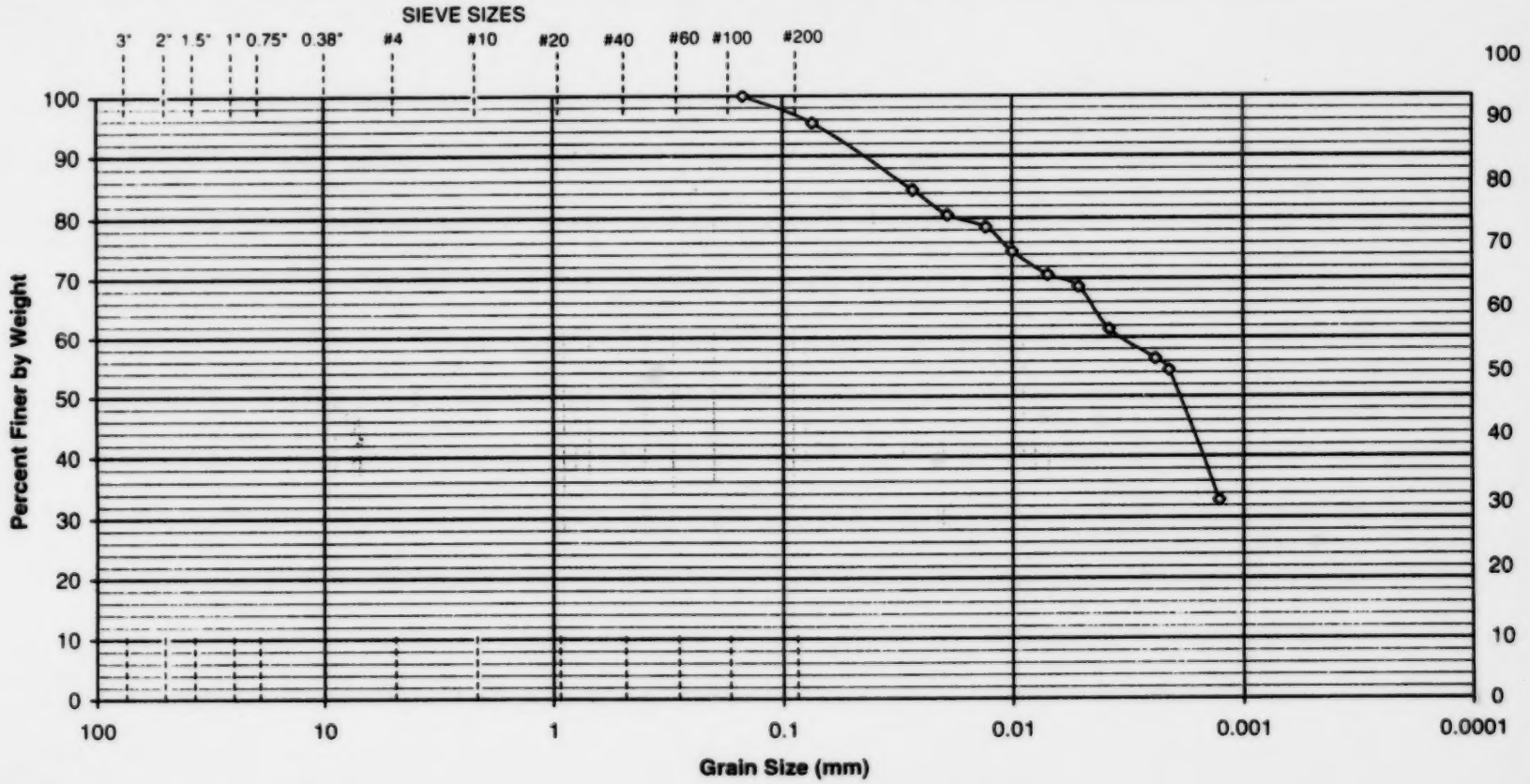
THE CITY OF Edmonton ENGINEERING SERVICES PUBLIC WORKS

GRAIN SIZE ANALYSIS

PROJECT: Recycled Aggregate Study
LOCATION: 111 Avenue - 186 Street to Anthony Henday Dr.
TEST HOLE: 1-1 **DATE TESTED:** 08/19/02
DEPTH (m): 0.0-0.3 **TECHNICIAN:** M.P, D.W.F.

SUMMARY OF TEST RESULTS

% Gravel:			
% Sand:	6.0	$D_{10\%}$ =	mm
% Silt:	46	$D_{60\%}$ =	mm
%Clay:	48	$C_u = D_{60\%} / D_{10\%}$ =	



M.I.T. Grain Size Scale	GRAVEL			SAND			SILT			CLAY
	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	

20 6.0 2.0 0.6 0.2 0.06 0.02 0.006 0.002 Grain Size (mm)

Atterberg Limits Liquid Limit =63 Plastic Limit = 29 In-stiu Moisture =25.8%

Ref. ASTM D422

FIGURE NO. 1

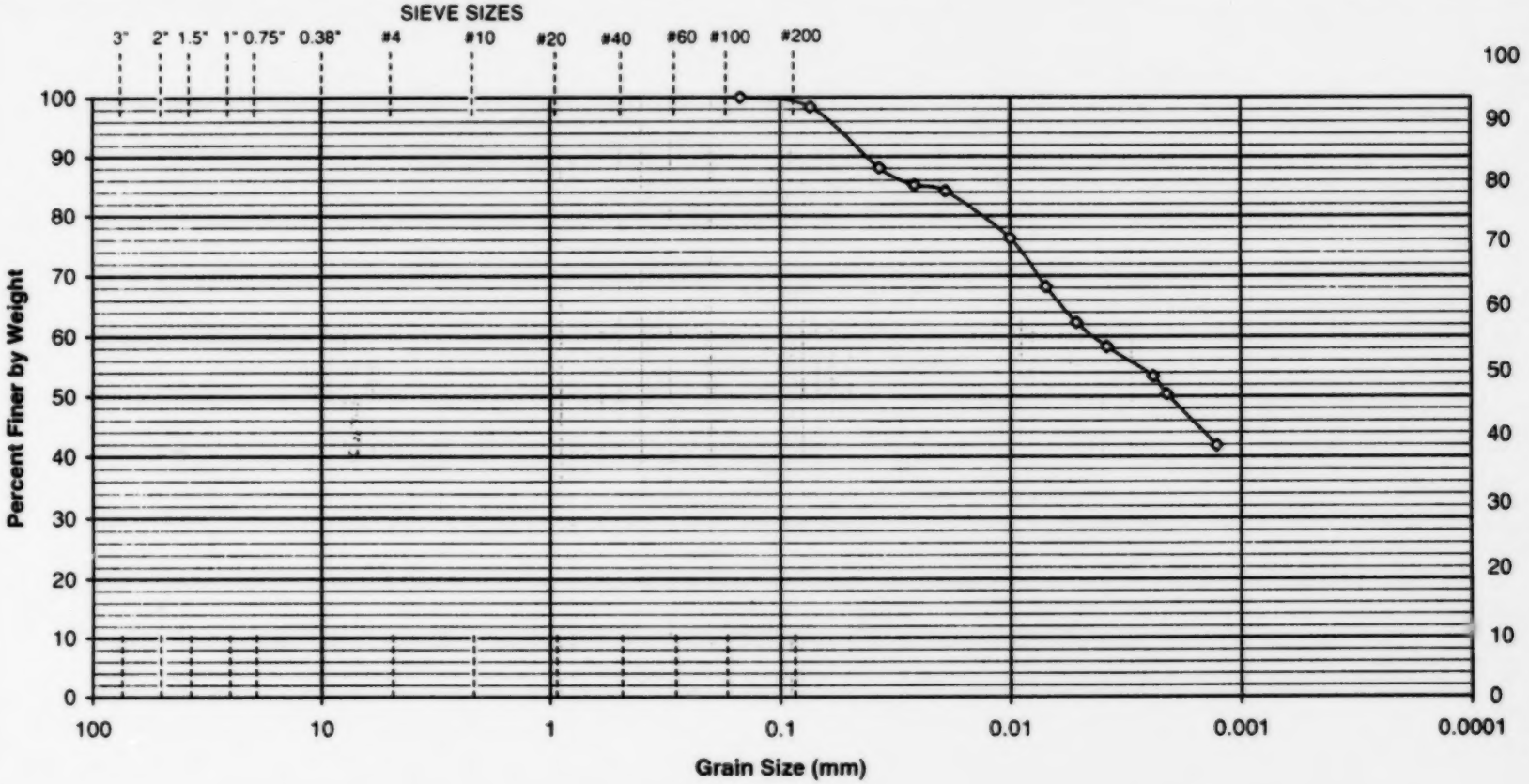
THE CITY OF Edmonton PUBLIC WORKS
ENGINEERING SERVICES

GRAIN SIZE ANALYSIS

PROJECT: Recycled Aggregate Study
LOCATION: 111 Avenue - 186 Street to Anthony Henday Dr.
TEST HOLE: 1-2 **DATE TESTED:** 08/19/02
DEPTH (m): 0.0-0.3 **TECHNICIAN:** M.P, D.W.F.

SUMMARY OF TEST RESULTS

% Gravel:			
% Sand:	3.0	$D_{10\%}$ =	mm
% Silt:	49	$D_{60\%}$ =	mm
%Clay:	48	$C_u = D_{60\%} / D_{10\%}$ =	



M.I.T. Grain Size Scale	GRAVEL			SAND			SILT			CLAY
	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	
	20	6.0	2.0	0.6	0.2	0.06	0.02	0.006	0.002	Grain Size (mm)

Atterberg Limits Liquid Limit = 46.3 Plastic Limit = 25.8 In-stiu Moisture =26.5%

Ref. ASTM D422

FIGURE NO. 1

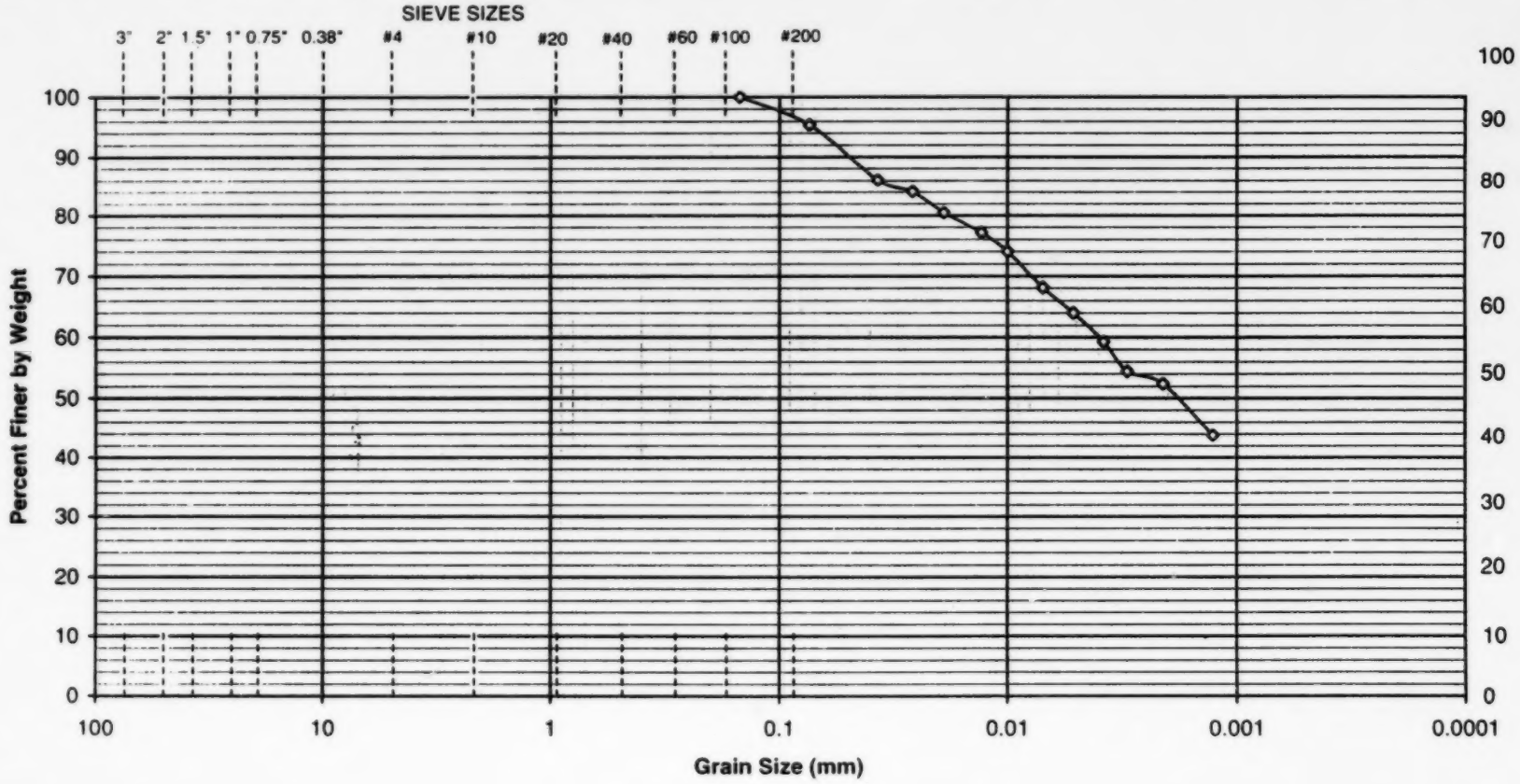
THE CITY OF Edmonton PUBLIC WORKS
ENGINEERING SERVICES

GRAIN SIZE ANALYSIS

PROJECT: Recycled Aggregate Study
LOCATION: 111 Avenue - 186 Street to Anthony Henday Dr.
TEST HOLE: 1-3 **DATE TESTED:** 08/19/02
DEPTH (m): 0.0-0.3 **TECHNICIAN:** M.P, D.W.F.

SUMMARY OF TEST RESULTS

% Gravel:			
% Sand:	6.0	$D_{10\%}$ =	mm
% Silt:	49	$D_{60\%}$ =	mm
%Clay:	45	$C_u = D_{60\%} / D_{10\%}$ =	



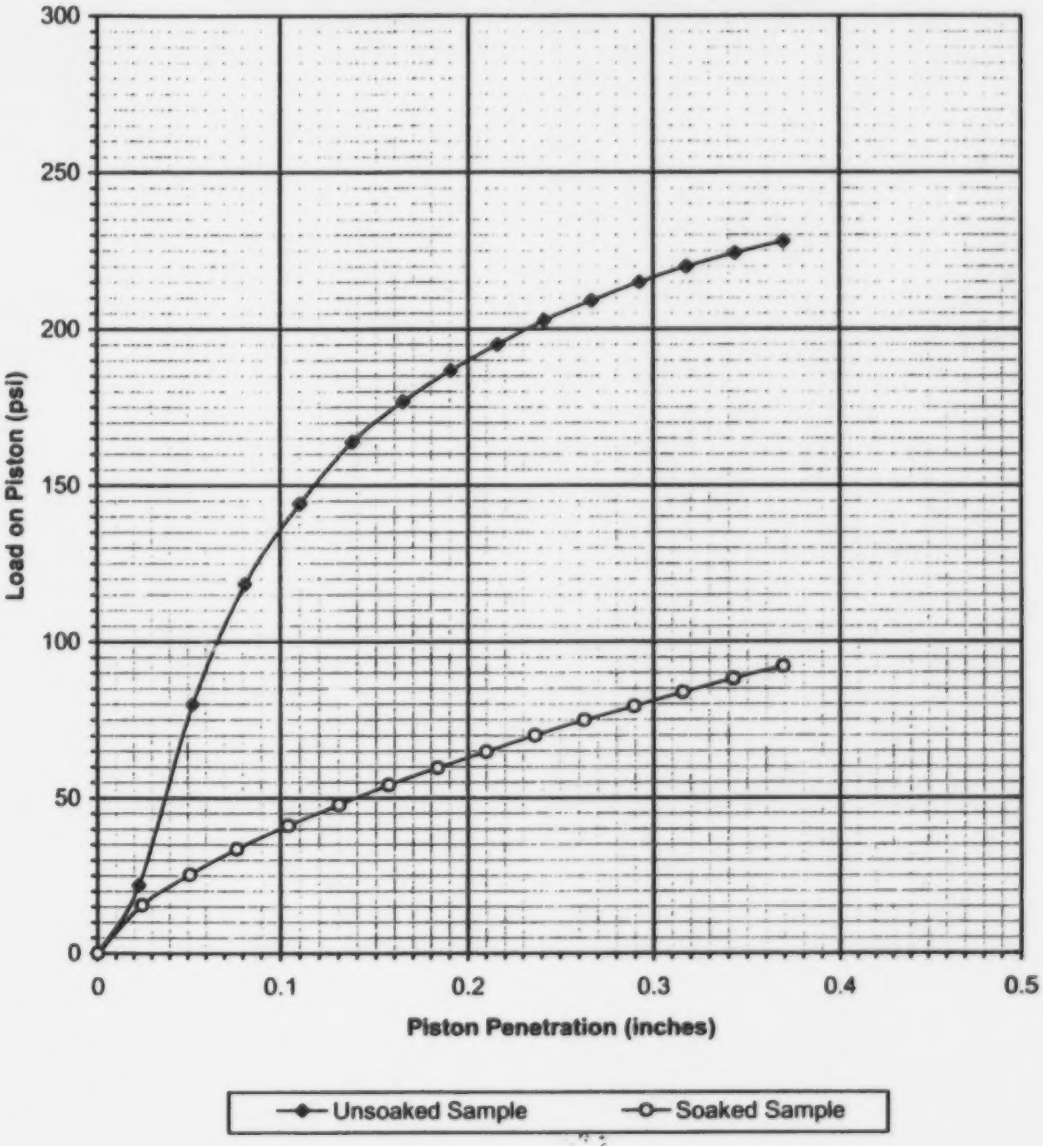
M.I.T. Grain Size Scale	GRAVEL			SAND			SILT			CLAY
	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	
	20	6.0	2.0	0.6	0.2	0.06	0.02	0.006	0.002	Grain Size (mm)

Atterberg Limits Liquid Limit = 59.5 Plastic Limit = 28.3 In-stiu Moisture =26.0

Ref. ASTM D422

FIGURE NO. 1

CALIFORNIA BEARING RATIO



Ref. ASTM D1833		UNSOAKED	SOAKED
CORRECTED 0.1" PENETRATION (psi)		130	40
CORRECTED 0.2" PENETRATION (psi)		185	63
CALIFORNIA BEARING RATIO		13.0	4.0
MOISTURE CONTENT (%)	TOP 3 cm		26.7
	MIDDLE	20.0	20.0
	BOTTOM 3cm		21.4
SURCHARGE WEIGHT = 24.8 kg		PERCENT SWELL = 0	
AVERAGE DRY DENSITY = 1603 kg/m^3 at 20 % M.C.			

THE CITY OF Edmonton PUBLIC WORKS ENGINEERING SERVICES

Test section 2-1
111Ave. - 184 St.

TEST HOLE NO:
DEPTH (m):
DATE TESTED:
FIGURE NO.

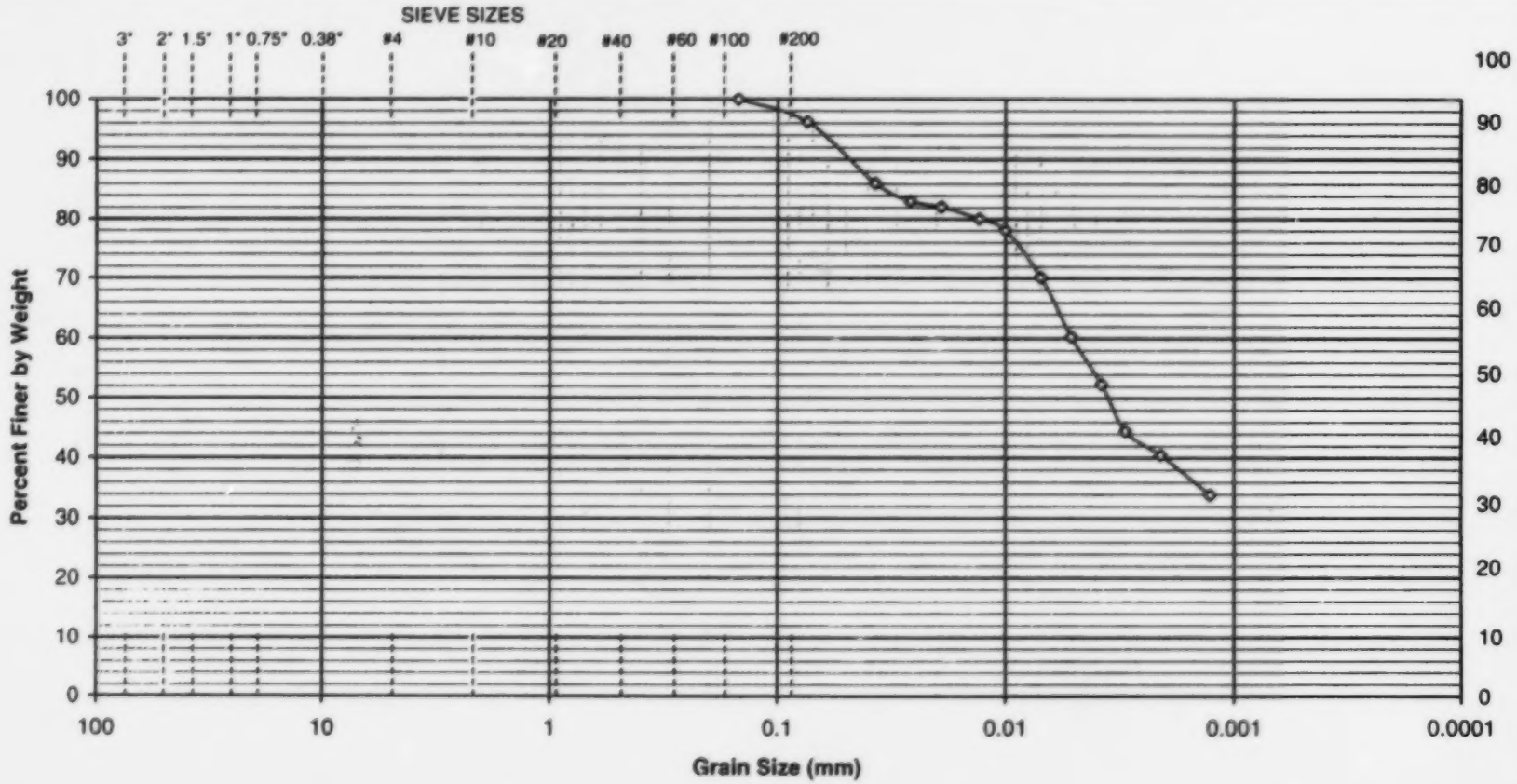
THE CITY OF Edmonton ENGINEERING SERVICES PUBLIC WORKS

GRAIN SIZE ANALYSIS

PROJECT: Recycled Aggregate Study
LOCATION: 111 Avenue - 186 Street to Anthony Henday Dr.
TEST HOLE: 2-1 **DATE TESTED:** 08/19/02
DEPTH (m): 0.0-0.3 **TECHNICIAN:** M.P, D.W.F.

SUMMARY OF TEST RESULTS

% Gravel:			
% Sand:	5.0	$D_{10\%}$ =	mm
% Silt:	57	$D_{60\%}$ =	mm
%Clay:	38	$C_u = D_{60\%} / D_{10\%}$ =	



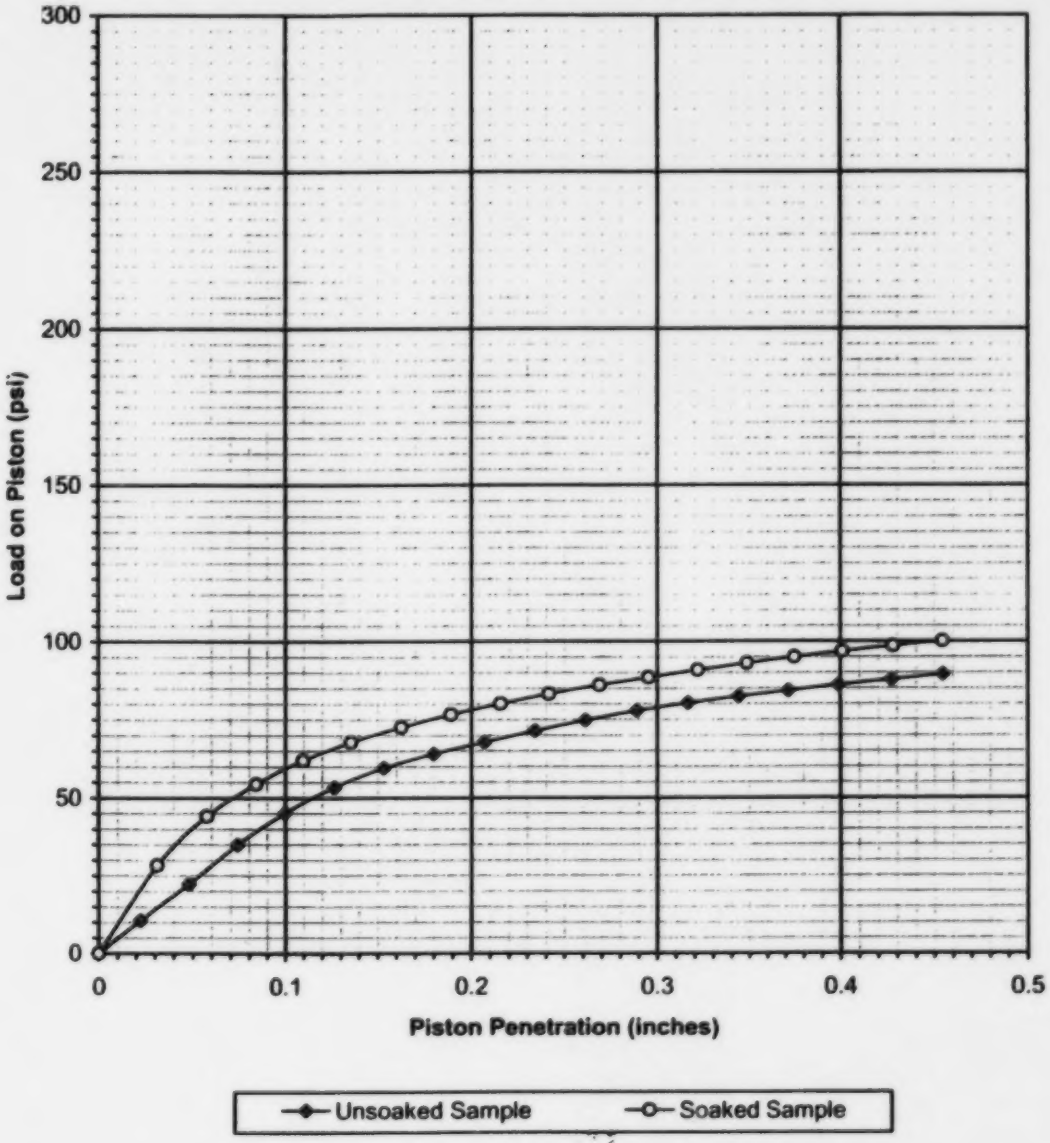
M.I.T. Grain Size Scale	GRAVEL			SAND			SILT			CLAY
	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	
	20	6.0	2.0	0.6	0.2	0.06	0.02	0.006	0.002	Grain Size (mm)

Atterberg Limits Liquid Limit = 51.2 Plastic Limit = 24.0 In-stiu Moisture =20.4

Ref. ASTM D422

FIGURE NO. 1

CALIFORNIA BEARING RATIO



Ref. ASTM D1833		UNSOAKED	SOAKED
CORRECTED 0.1" PENETRATION (psi)		45	60
CORRECTED 0.2" PENETRATION (psi)		66	78
CALIFORNIA BEARING RATIO		4.5	6.0
MOISTURE CONTENT (%)	TOP 3 cm	24.8	24.0
	MIDDLE		23.7
	BOTTOM 3cm		23.3
SURCHARGE WEIGHT = 25.9 kg		PERCENT SWELL = 0.5	
AVERAGE DRY DENSITY = 1575 kg/m^3 at 25 % M.C.			

THE CITY OF Edmonton PUBLIC WORKS
ENGINEERING SERVICES

Test section 2 - 3
111 AVE. - 184 ST.

TEST HOLE NO:
DEPTH (m):
DATE TESTED:

FIGURE NO.

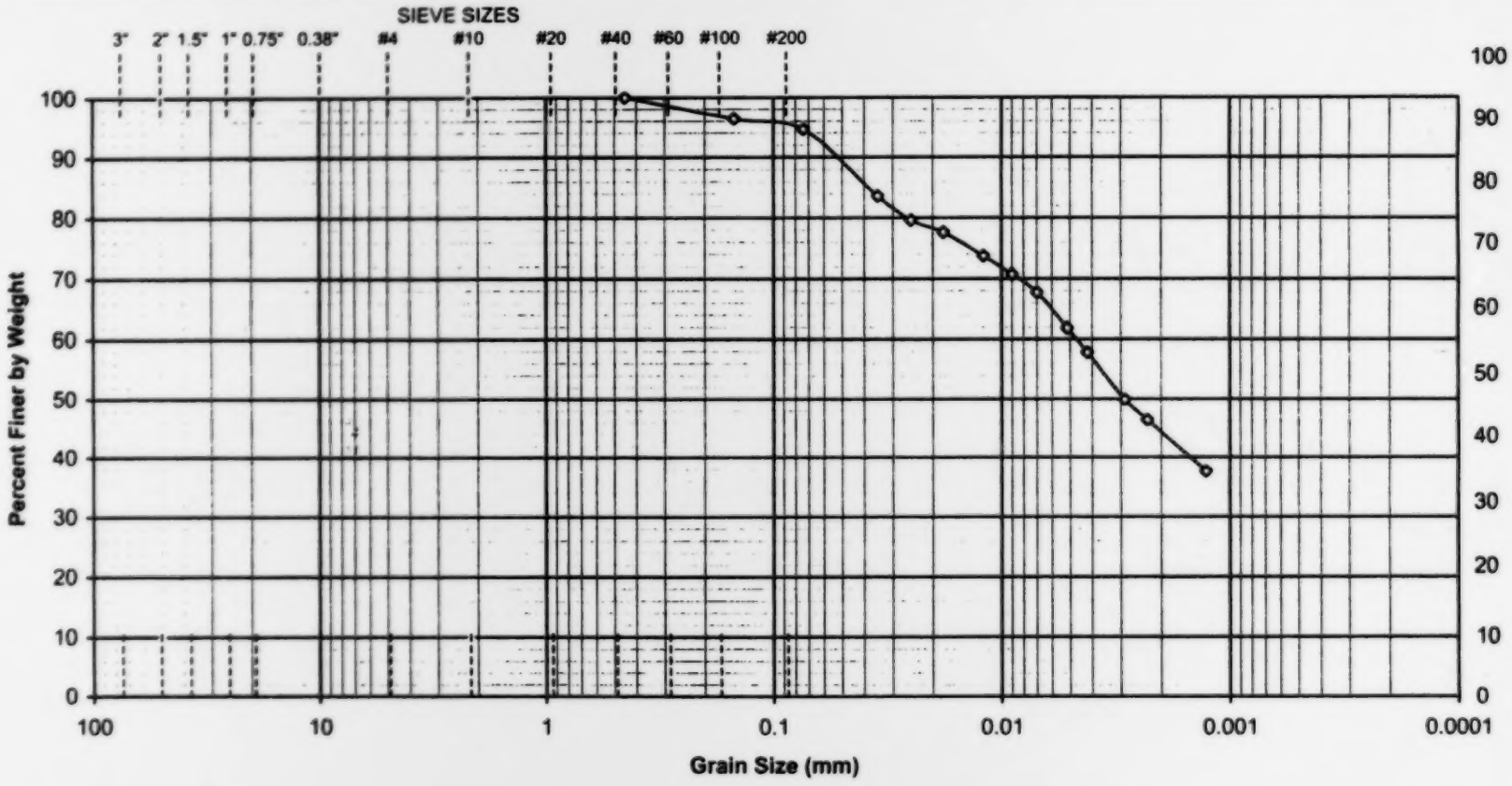
THE CITY OF Edmonton ENGINEERING SERVICES PUBLIC WORKS

GRAIN SIZE ANALYSIS

PROJECT: Recycled Aggregate study
LOCATION: 111 Avenue - 186 Street to Anthony Henday Dr.
TEST HOLE: 2 - 3 **DATE TESTED:** 02-10-10
DEPTH (m): 0 .3 **TECHNICIAN:** dp

SUMMARY OF TEST RESULTS

% Gravel:			
% Sand:	6	$D_{10\%}$ =	mm
% Silt:	50	$D_{60\%}$ =	mm
%Clay:	44	$C_u = D_{60\%} / D_{10\%}$ =	



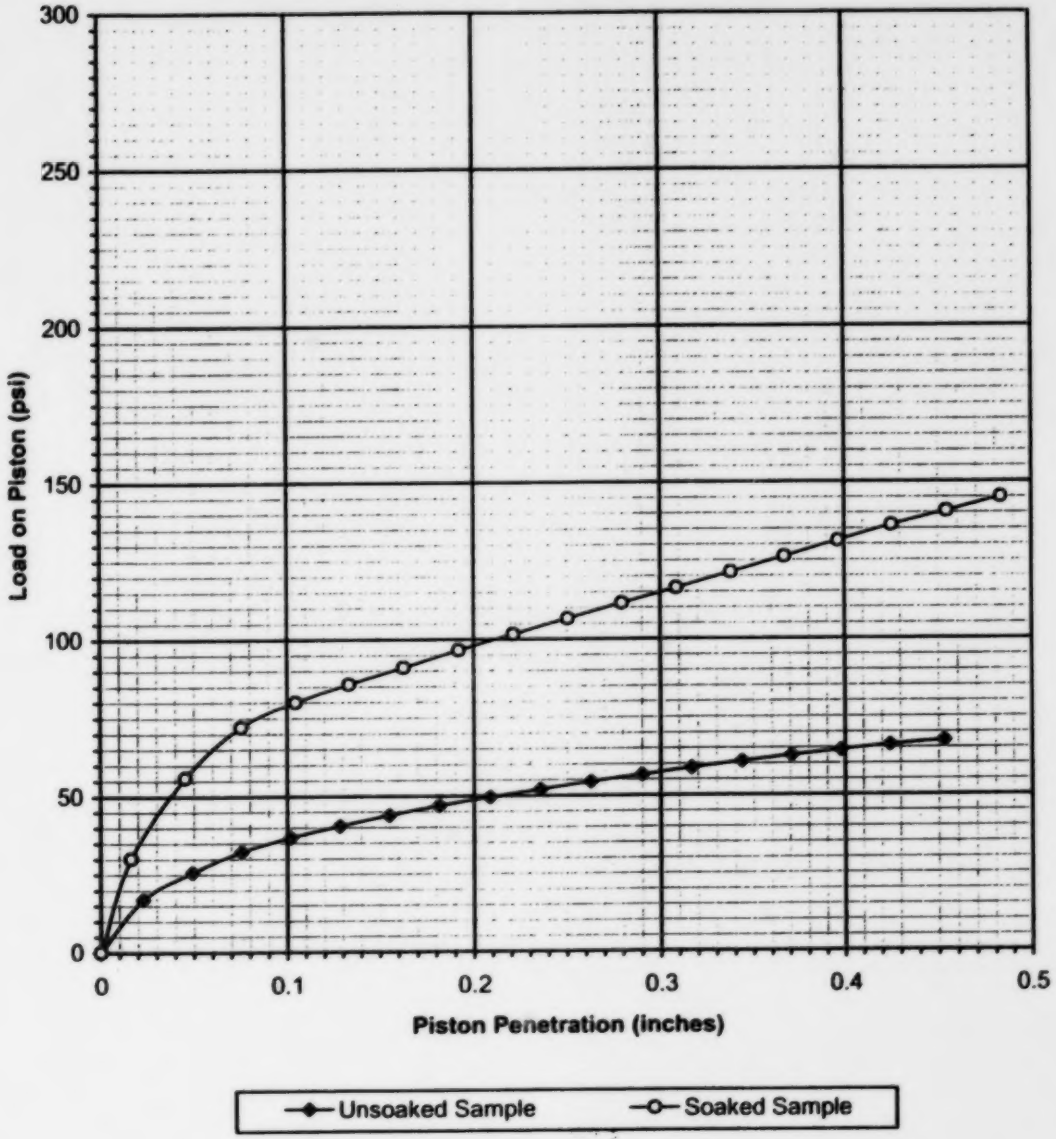
M.I.T. Grain Size Scale	GRAVEL			SAND			SILT			CLAY
	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	
	20	6.0	2.0	0.6	0.2	0.06	0.02	0.006	0.002	Grain Size (mm)

Attergerg Limits Liquid Limit =54 Plastic Limit = 28

Ref. ASTM D422

FIGURE NO. 1

CALIFORNIA BEARING RATIO



Ref. ASTM D1833		UNSOAKED	SOAKED
CORRECTED 0.1" PENETRATION (psi)		37	79
CORRECTED 0.2" PENETRATION (psi)		48	97
CALIFORNIA BEARING RATIO		3.7	7.9
MOISTURE CONTENT (%)	TOP 3 cm	22.0	25.0
	MIDDLE		22.8
	BOTTOM 3cm		23.1
SURCHARGE WEIGHT = 25.2 kg		PERCENT SWELL = 0.9	
AVERAGE DRY DENSITY = 1585 kg/m^3 at 22 % M.C.			

THE CITY OF Edmonton ENGINEERING SERVICES PUBLIC WORKS

Test Section 3-1
111 AVE. - 184 ST.

TEST HOLE NO:

DEPTH (m):

DATE TESTED:

FIGURE NO.

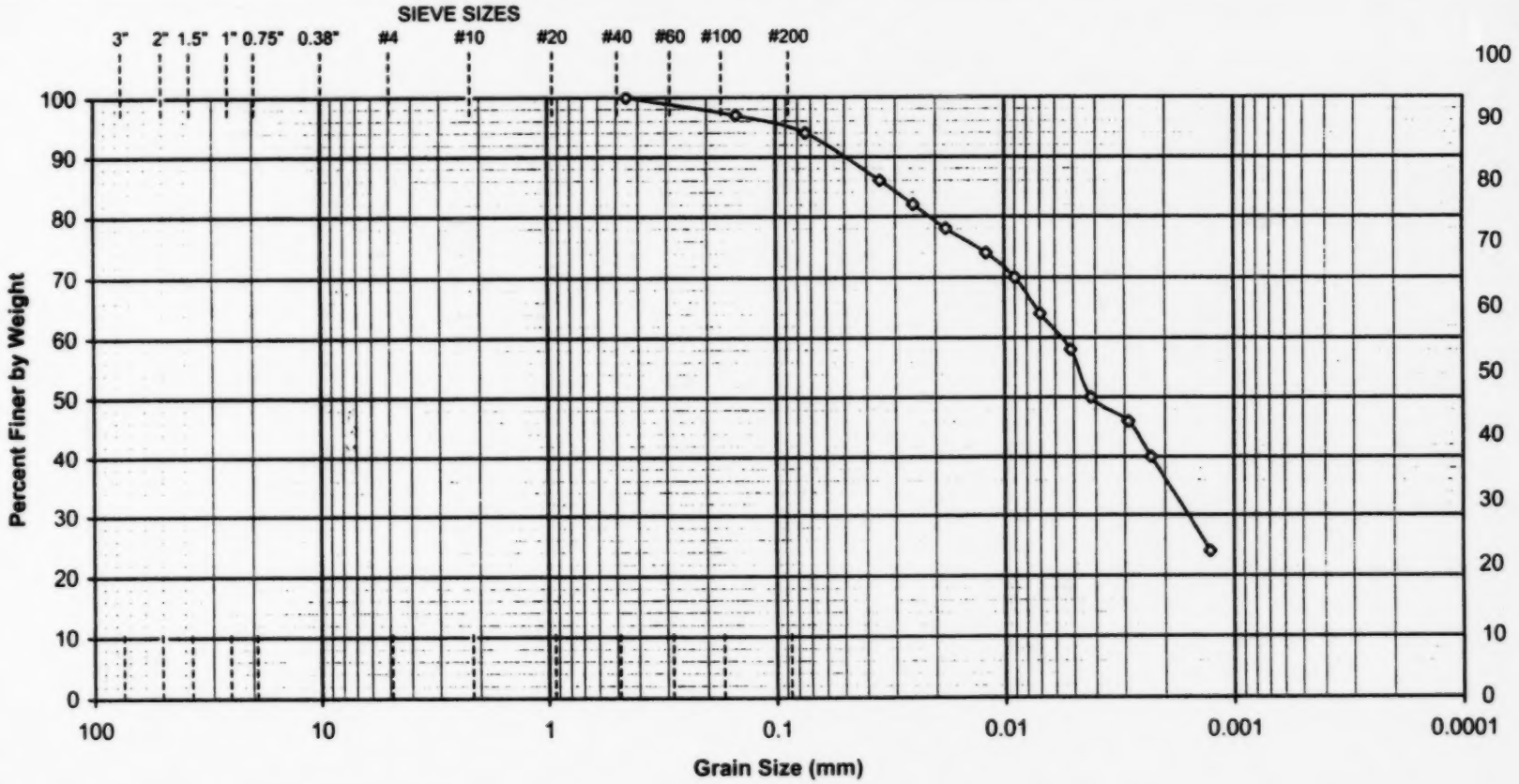
THE CITY OF Edmonton PUBLIC WORKS
ENGINEERING SERVICES

GRAIN SIZE ANALYSIS

PROJECT: Recycled Aggregate study
LOCATION: 111 Avenue - 186 Street to Anthony Henday Dr.
TEST HOLE: 3 - 1 **DATE TESTED:** 02-10-10
DEPTH (m): 0 - .3 **TECHNICIAN:** dp

SUMMARY OF TEST RESULTS

% Gravel:			
% Sand:	6	$D_{10\%}$ =	mm
% Silt:	58	$D_{60\%}$ =	mm
%Clay:	36	$C_u = D_{60\%} / D_{10\%}$ =	



M.I.T. Grain Size Scale	GRAVEL			SAND			SILT			CLAY
	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	

20 6.0 2.0 0.6 0.2 0.06 0.02 0.006 0.002 Grain Size (mm)

Attergerg Limits Liquid Limit =48 Plastic Limit =18

Ref. ASTM D422

FIGURE NO. 1

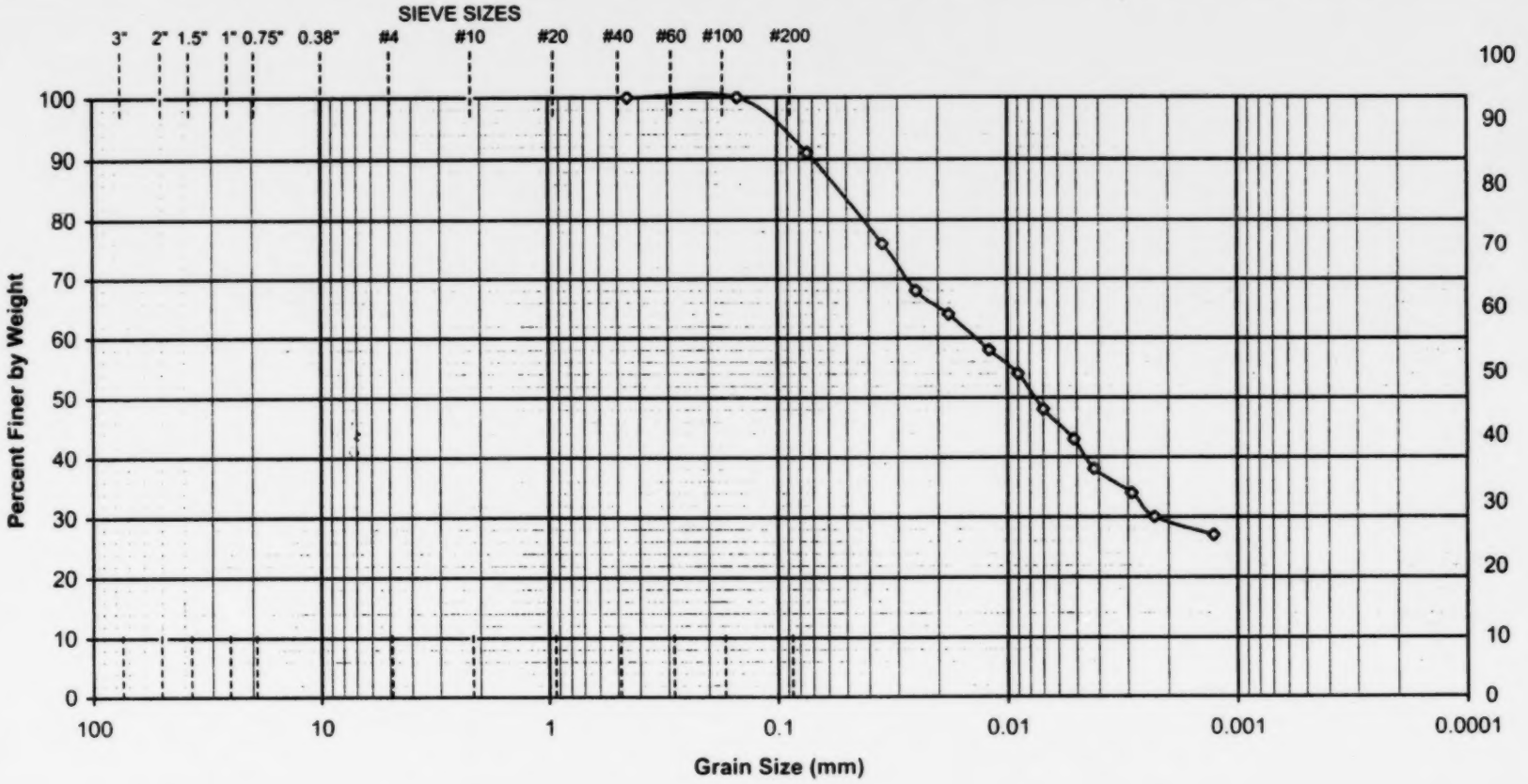
THE CITY OF Edmonton ENGINEERING SERVICES PUBLIC WORKS

GRAIN SIZE ANALYSIS

PROJECT: Recycled Aggregate Study
LOCATION: 111 Avenue - 186 Street to Anthony Henday Dr.
TEST HOLE: 3 - 2 **DATE TESTED:** 02-10-10
DEPTH (m): 0 - .3 **TECHNICIAN:** dp

SUMMARY OF TEST RESULTS

% Gravel:			
% Sand:	10	$D_{10\%}$ =	mm
% Silt:	61	$D_{60\%}$ =	mm
%Clay:	29	$C_u = D_{60\%} / D_{10\%}$ =	



M.I.T. Grain Size Scale	GRAVEL			SAND			SILT			CLAY
	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	

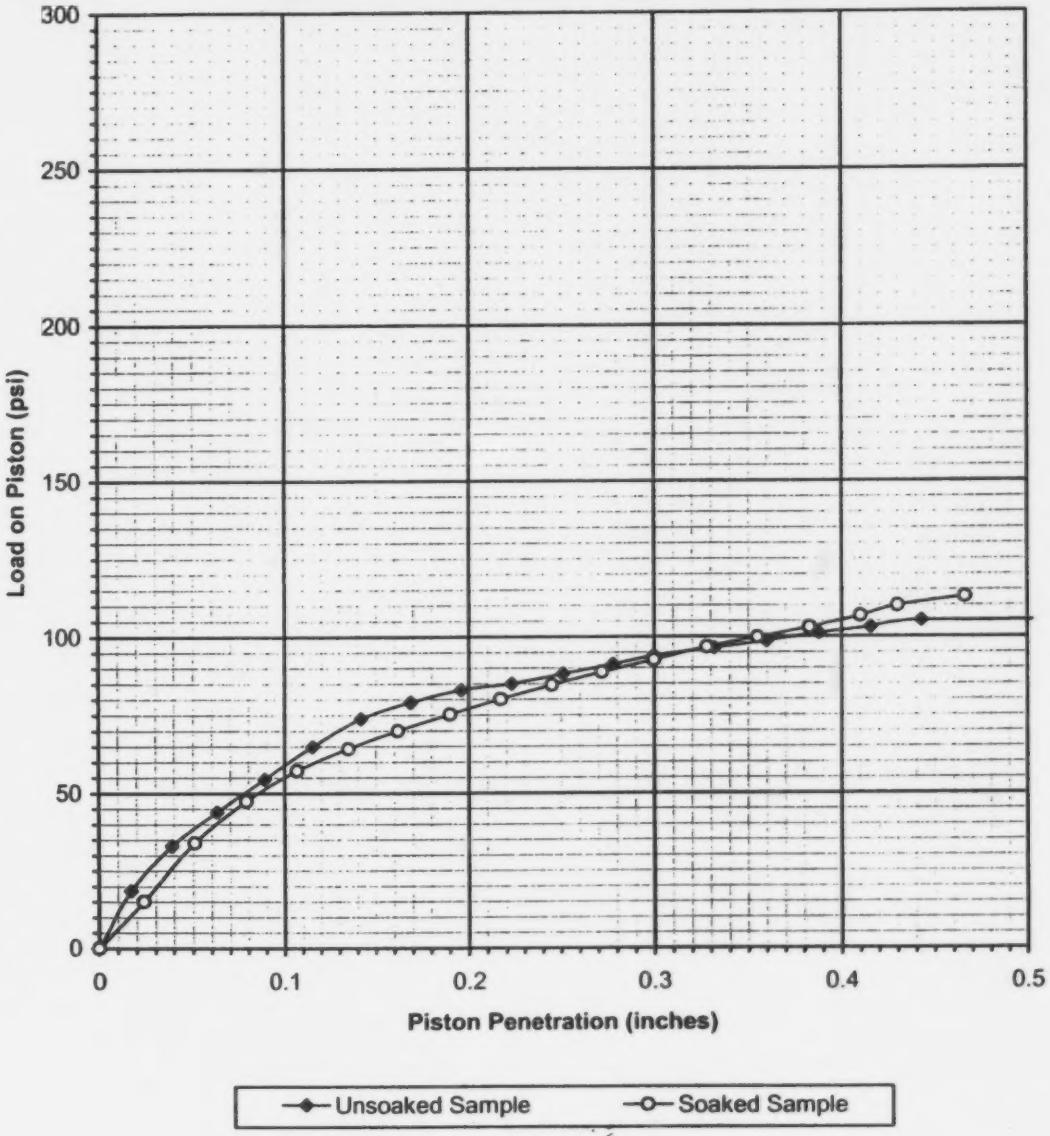
20 6.0 2.0 0.6 0.2 0.06 0.02 0.006 0.002 Grain Size (mm)

Attergerg Limits Liquid Limit = 37 Plastic Limit = 23

Ref. ASTM D422

FIGURE NO. 1

CALIFORNIA BEARING RATIO



Ref. ASTM D1833		UNSOAKED	SOAKED
CORRECTED 0.1" PENETRATION (psi)		60	55
CORRECTED 0.2" PENETRATION (psi)		83	77
CALIFORNIA BEARING RATIO		6.0	5.5
MOISTURE CONTENT (%)	TOP 3 cm	22.4	23.9
	MIDDLE		21.4
	BOTTOM 3cm		23.2
SURCHARGE WEIGHT = 24.7 kg		PERCENT SWELL = 0	
AVERAGE DRY DENSITY = 1614 kg/m^3 at 22.4 % M.C.			

THE CITY OF Edmonton ENGINEERING SERVICES PUBLIC WORKS

Test Section 3-3
111 AVE. - 184 ST.

TEST HOLE NO:

DEPTH (m):

DATE TESTED: 02-10-11

FIGURE NO.

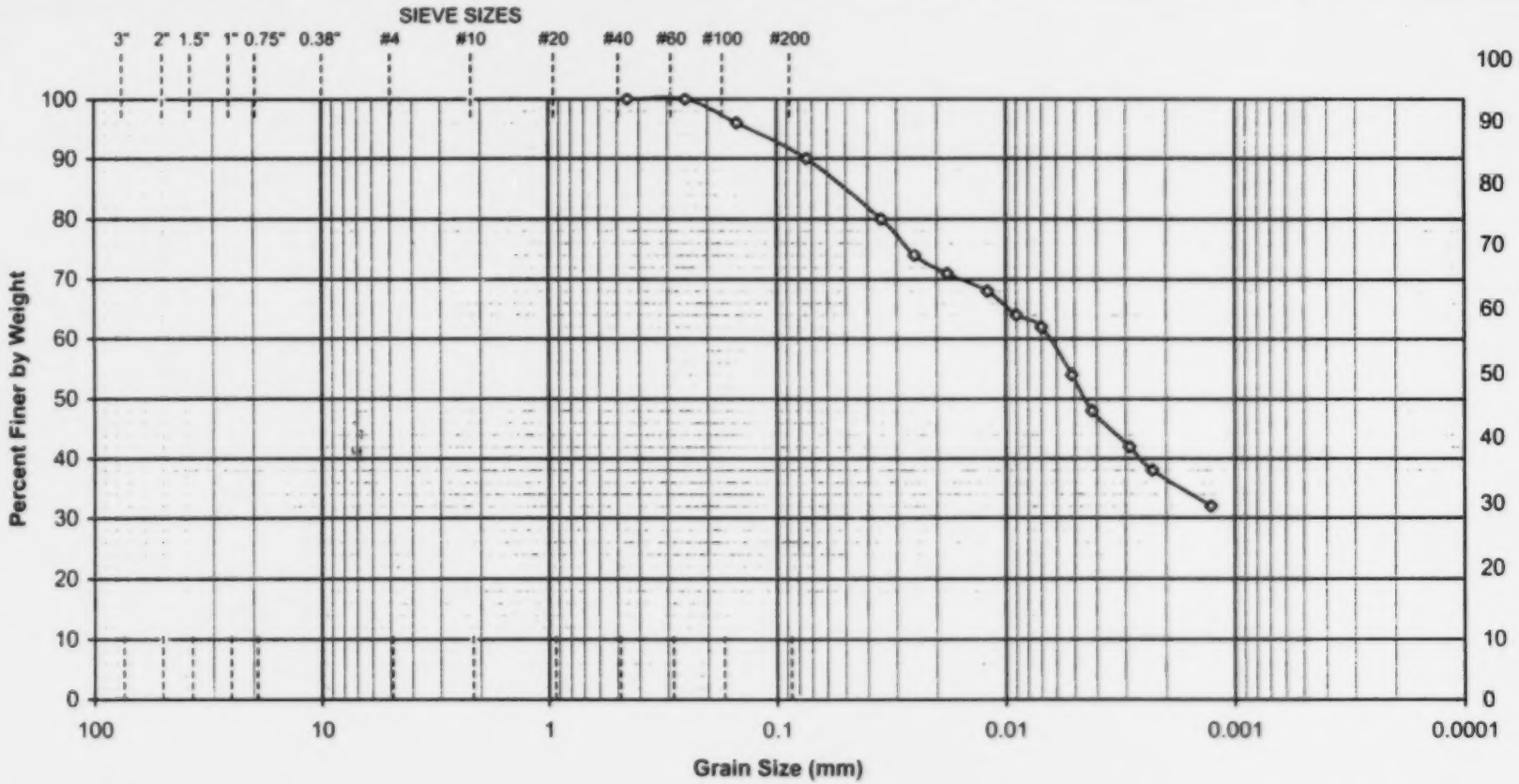
THE CITY OF Edmonton PUBLIC WORKS
ENGINEERING SERVICES

GRAIN SIZE ANALYSIS

PROJECT: Recycled Aggregate Study
LOCATION: 111 Avenue - 186 Street to Anthony Henday dr.
TEST HOLE: 3 - 3 **DATE TESTED:** 2002/10/10
DEPTH (m): 0 - .3 **TECHNICIAN:** dp

SUMMARY OF TEST RESULTS

% Gravel:			
% Sand:	11	$D_{10\%}$ =	mm
% Silt:	53	$D_{60\%}$ =	mm
%Clay:	36	$C_u = D_{60\%} / D_{10\%}$ =	



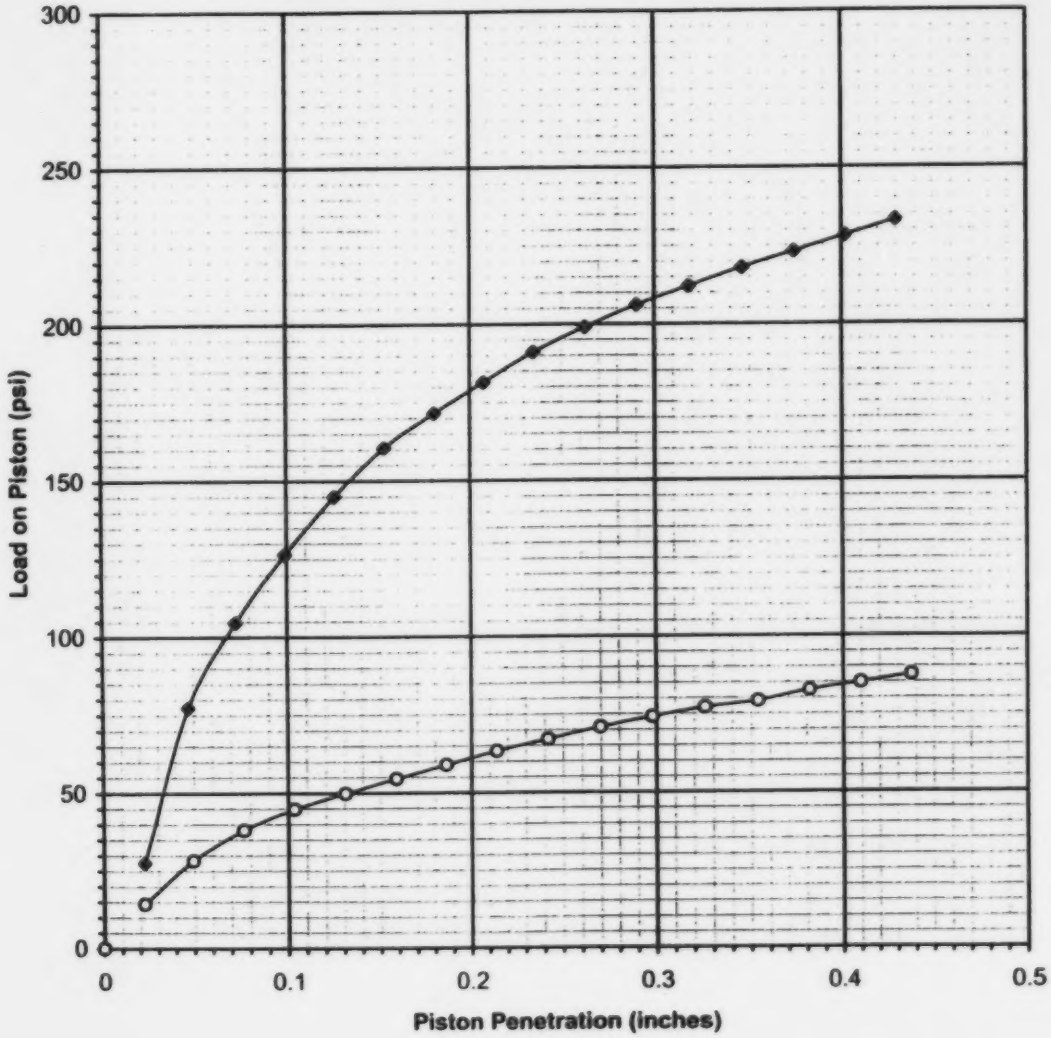
M.I.T. Grain Size Scale	GRAVEL			SAND			SILT			CLAY
	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	
	20	6.0	2.0	0.6	0.2	0.06	0.02	0.006	0.002	Grain Size (mm)

Attergerg Limits Liquid Limit =43 Plastic Limit =24

Ref. ASTM D422

FIGURE NO. 1

CALIFORNIA BEARING RATIO



Ref. ASTM D1833		UNSOAKED	SOAKED
CORRECTED 0.1" PENETRATION (psi)		42	61
CORRECTED 0.2" PENETRATION (psi)		126	178
CALIFORNIA BEARING RATIO		4.2	6.1
MOISTURE CONTENT (%)	TOP 3 cm		29.7
	MIDDLE		22.6
	BOTTOM 3cm		24.7
SURCHARGE WEIGHT = 25.8 kg		PERCENT SWELL = 0.9	
AVERAGE DRY DENSITY = 1545 kg/m^3 at 22.2 % M.C.			

THE CITY OF Edmonton ENGINEERING SERVICES PUBLIC WORKS

Test section 4 - 2
111 AVE. - 184 ST.

TEST HOLE NO.:
DEPTH (m):
DATE TESTED: 02-10-11
FIGURE NO.:

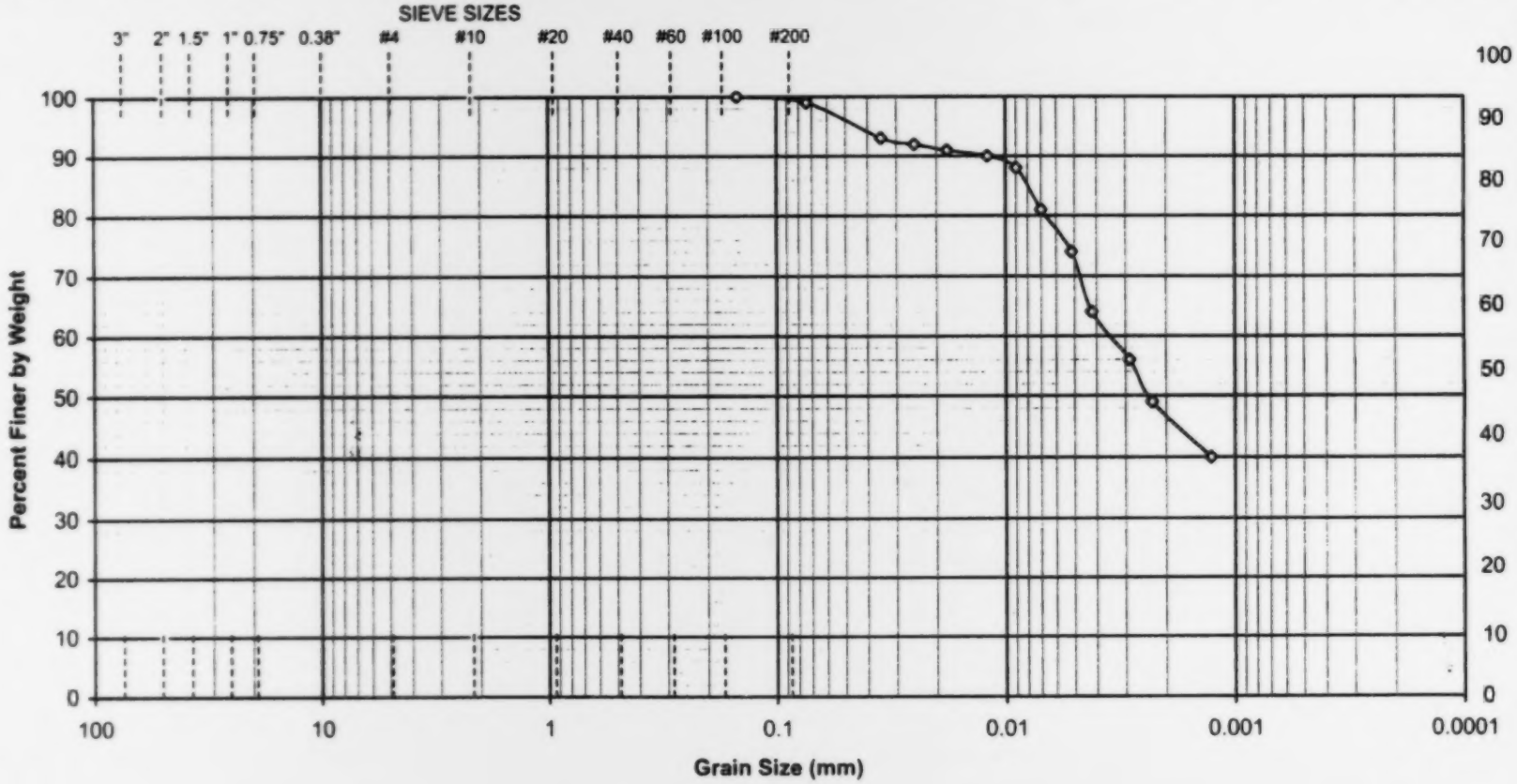
THE CITY OF Edmonton PUBLIC WORKS
ENGINEERING SERVICES

GRAIN SIZE ANALYSIS

PROJECT: Recycled Aggregate Study
LOCATION: 111 Avenue - 186 Street to Anthony Henday dr.
TEST HOLE: 4 - 2 **DATE TESTED:** 02-10-10
DEPTH (m): 0 - .3 **TECHNICIAN:** dp

SUMMARY OF TEST RESULTS

% Gravel:			
% Sand:	2	$D_{10\%}$ =	mm
% Silt:	52	$D_{60\%}$ =	mm
%Clay:	46	$C_u = D_{60\%} / D_{10\%}$ =	



M.I.T. Grain Size Scale	GRAVEL			SAND			SILT			CLAY
	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	

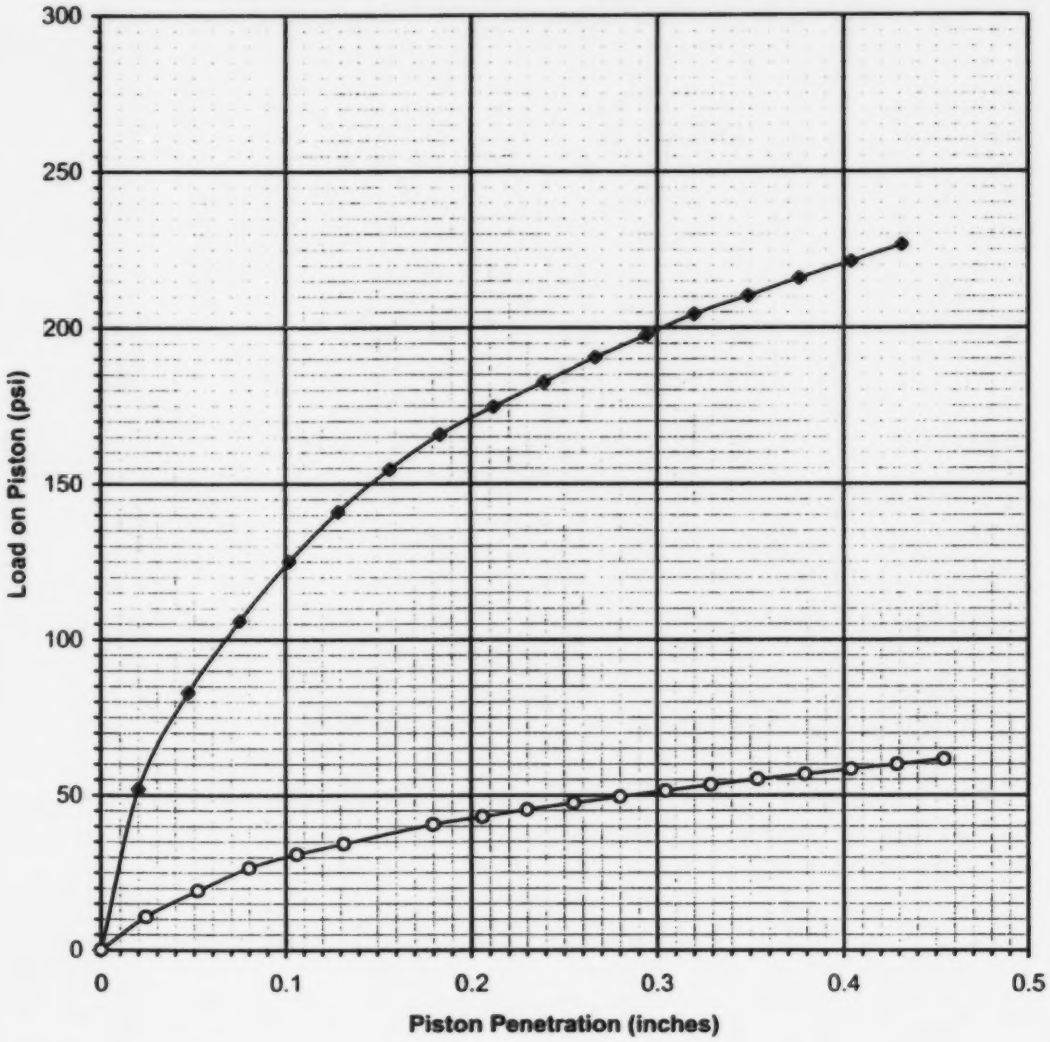
20 6.0 2.0 0.6 0.2 0.06 0.02 0.006 0.002 Grain Size (mm)

Attergerg Limits Liquid Limit =53 Plastic Limit =29

Ref. ASTM D422

FIGURE NO. 1

CALIFORNIA BEARING RATIO



Ref. ASTM D1833		UNSOAKED	SOAKED
CORRECTED 0.1" PENETRATION (psi)		125	30
CORRECTED 0.2" PENETRATION (psi)		170	125
CALIFORNIA BEARING RATIO		12.5	3.0
MOISTURE CONTENT (%)	TOP 3 cm		30.3
	MIDDLE	20.0	25.1
	BOTTOM 3cm		25.8
SURCHARGE WEIGHT = 24.8 kg		PERCENT SWELL = 0.9	
AVERAGE DRY DENSITY = 1549 kg/m^3 at 20 % M.C.			

THE CITY OF Edmonton ENGINEERING SERVICES PUBLIC WORKS

Test Section 4-3
111 AVE. - 184 ST.

TEST HOLE NO:
DEPTH (m):
DATE TESTED: 02-10-11

FIGURE NO.

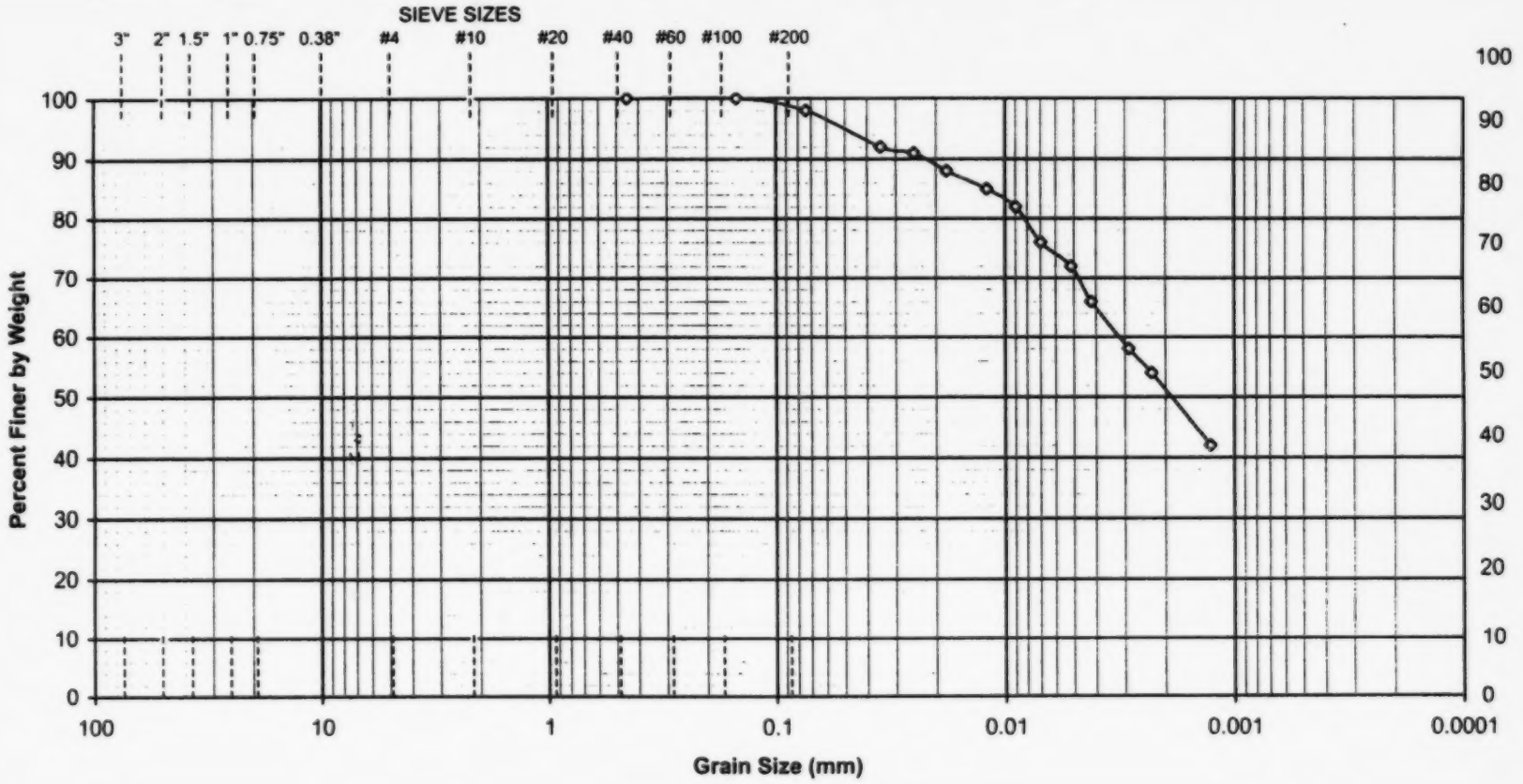
THE CITY OF Edmonton PUBLIC WORKS
ENGINEERING SERVICES

GRAIN SIZE ANALYSIS

PROJECT: Recycled Aggregate Study
LOCATION: 111 Avenue - 186 Street to Anthony Henday Dr.
TEST HOLE: 4-3 **DATE TESTED:** 02-10-10
DEPTH (m): 0 - .3 **TECHNICIAN:** dp

SUMMARY OF TEST RESULTS

% Gravel:			
% Sand:	3	$D_{10\%}$ =	mm
% Silt:	47	$D_{60\%}$ =	mm
%Clay:	50	$C_u = D_{60\%} / D_{10\%}$ =	



M.I.T. Grain Size Scale	GRAVEL			SAND			SILT			CLAY
	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	
	20	6.0	2.0	0.6	0.2	0.06	0.02	0.006	0.002	Grain Size (mm)

Attergerg Limits Liquid Limit = 54 Plastic Limit = 28

Ref. ASTM D422

FIGURE NO. 1

APPENDIX B

APPENDIX B

Materials Testing Field and Laboratory Test Results

Edmonton

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

Monday September 23, 2002

FIELD DENSITY TEST REPORT

Contract ID: AMPW
Contract: 111 Avenue, 186 Street to Anthony Henday Drive
Sample No: 1 **Sample Date:** Tuesday August 06, 2002 @ 05:00 PM
Client: A. Cepas
Contractor: Standard General Inc.
Location: Road Base - 111 Avenue West of 186 Street on Centerline.

Station: 1+461 **Depth:** @ Grade **Technician:** Bret Neil
Material: Cement Stabilized Subgrade

Dry Density:	1582 kg/m3	**Moisture Content:**	23.6%
Proctor Density:	1586 kg/m3	**Moisture Content:**	23.7%
Adjusted Proctor Density:	kg/m3	**Moisture Content:**	%
% Passing 5mm:	%	**Percent Compaction:**	99.7%

Required Compaction: 100% of a Standard Proctor

REMARKS: Test Section #1, Sample #2
*No retest - Inspector

SUPERVISOR **ENGINEER**

SO-004

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Edmonton

Monday September 23, 2002

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

FIELD DENSITY TEST REPORT

Contract ID: AMPW

Contract: 111 Avenue, 186 Street to Anthony Henday Drive

Sample No: 2 **Sample Date:** Tuesday August 06, 2002 @ 05:20 PM

Client: A. Cepas

Contractor: Standard General Inc.

Location: Road Base - 111 Avenue West of 186 Street, 4.5m South of Centerline.

Station: 1+510 **Depth:** @ Grade **Technician:** Bret Neil

Material: Cement Stabilized Subgrade

Dry Density:	1586 kg/m3	**Moisture Content:**	22.6%
Proctor Density:	1581 kg/m3	**Moisture Content:**	24.2%
Adjusted Proctor Density:	kg/m3	**Moisture Content:**	.%
% Passing 5mm:	%	**Percent Compaction:**	100.3%

Required Compaction: 100% of a Standard Proctor

REMARKS: Test Section #1, Sample #1

SUPERVISOR

SD-004

ENGINEER

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Edmonton

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

Monday September 23, 2002

FIELD DENSITY TEST REPORT

Contract ID: AMPW
Contract: 111 Avenue, 186 Street to Anthony Henday Drive
Sample No: 3 **Sample Date:** Wednesday August 07, 2002 @ 04:20 PM
Client: A. Cepas
Contractor: Standard General Inc.
Location: Road Base - 111 Avenue West of 186 Street, 3m North of Centerline.

Station: 1+410 **Depth:** @ Grade **Technician:** Bret Neil
Material: Cement Stabilized Subgrade

Dry Density:	1571 kg/m3	**Moisture Content:**	22.0%
Proctor Density:	1563 kg/m3	**Moisture Content:**	24.0%
Adjusted Proctor Density:	kg/m3	**Moisture Content:**	%
% Passing 5mm:	%	**Percent Compaction:**	100.5%

Required Compaction: 100% of a Standard Proctor

REMARKS: Test Section #1, Sample #3

SUPERVISOR **ENGINEER**

50-604

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Edmonton

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

Thursday September 26, 2002

FIELD DENSITY TEST REPORT

Contract ID: AMPW
Contract: 111 Avenue, 186 Street to Anthony Henday Drive
Sample No: 5 **Sample Date:** Saturday August 10, 2002 @ 03:55 PM
Client: A. Cepas
Contractor: Standard General Inc.
Location: Road Base - 111 Avenue West of 186 Street, 5m North of Centerline.

Station: 1+410 **Depth:** @ Grade **Technician:** Mauro Bagnariol
Material: 20mm Gravel

Dry Density:	2134 kg/m3	**Moisture Content:**	4.6%
Proctor Density:	2149 kg/m3	**Moisture Content:**	7.1%
Adjusted Proctor Density:	kg/m3	**Moisture Content:**	%
% Passing 5mm:	%	**Percent Compaction:**	99.3%

Required Compaction: 100% of a Standard Proctor

REMARKS: Test Section #1, Sample #3. No retests - Inspector.
Standard General 20mm crushed gravel - Inland Pit #45

SUPERVISOR SO-004 **ENGINEER**

This information is being collected under the Authority of Section 33(c) of the Freedom of Information and Protection of Privacy Act (F.O.I.P.) and will be used for the business of the City of Edmonton. It is protected by the privacy provisions of the F.O.I.P. Act. If you have any questions about the collection of this data, please contact the Streets Engineering Branch's Administrative Assistant 944-7607.

Edmonton

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

Thursday September 26, 2002

FIELD DENSITY TEST REPORT

Contract ID: AMPW
Contract: 111 Avenue, 186 Street to Anthony Henday Drive
Sample No: 6 **Sample Date:** Saturday August 10, 2002 @ 04:10 PM
Client: A. Cepas
Contractor: Standard General Inc.
Location: Road Base - 111 Avenue, West of 186 Street on Centerline.

Station: 1+461 **Depth:** @ Grade **Technician:** Mauro Bagnariol
Material: 20mm Gravel

Dry Density:	2082 kg/m3	**Moisture Content:**	3.9%
Proctor Density:	2149 kg/m3	**Moisture Content:**	7.1%
Adjusted Proctor Density:	kg/m3	**Moisture Content:**	%
% Passing 5mm:	%	**Percent Compaction:**	96.9%

Required Compaction: 100% of a Standard Proctor

REMARKS: Test Section #1, Sample #2.
Standard General 20mm crushed gravel, Inland Pit #45

SUPERVISOR

SO-004

ENGINEER

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Edmonton

Thursday September 26, 2002

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

FIELD DENSITY TEST REPORT

Contract ID: AMPW
Contract: 111 Avenue, 186 Street to Anthony Henday Drive
Sample No: 8 **Retest of Sample:** 6 **Sample Date:** Monday August 12, 2002 @ 09:45 AM
Client: A. Cepas
Contractor: Standard General Inc.
Location: Road Base - 111 Avenue, West of 186 Street on Centerline.

Station: 1+461 **Depth:** @ Grade **Technician:** Mauro Bagnariol
Material: 20mm Gravel

Dry Density:	2085 kg/m3	**Moisture Content:**	4.6%
Proctor Density:	2149 kg/m3	**Moisture Content:**	7.1%
Adjusted Proctor Density:	kg/m3	**Moisture Content:**	%
% Passing 5mm:	%	**Percent Compaction:**	97.0%

Required Compaction: 100% of a Standard Proctor

REMARKS: Test section #1, Sample #2
*repacked (#9) - Standard General 20mm crushed gravel, Inland Pit #45

SUPERVISOR **ENGINEER**

SO-004

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Edmonton

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

Thursday September 26, 200

FIELD DENSITY TEST REPORT

Contract ID: AMPW
Contract: 111 Avenue, 186 Street to Anthony Henday Drive
Sample No: 9 **Retest of Sample:** 6 **Sample Date:** Monday August 12, 2002 @ 02:00 PM
Client: A. Cepas
Contractor: Standard General Inc.
Location: Road Base - 111 Avenue, West of 186 Street on Centerline.

Station: 1+461 **Depth:** @ Grade **Technician:** Bret Neil
Material: 20mm Gravel

Dry Density:	2145 kg/m3	**Moisture Content:**	5.2%
Proctor Density:	2149 kg/m3	**Moisture Content:**	7.1%
Adjusted Proctor Density:	kg/m3	**Moisture Content:**	%
% Passing 5mm:	%	**Percent Compaction:**	99.8%

Required Compaction: 100% of a Standard Proctor

REMARKS: Test Section #1, Sample #2
*Standard General 20mm crushed gravel, Inland Pit #45

SUPERVISOR SO-004 **ENGINEER**

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Edmonton

Thursday September 26, 2002

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

FIELD DENSITY TEST REPORT

Contract ID: AMPW
Contract: 111 Avenue, 186 Street to Anthony Henday Drive
Sample No: 7 **Sample Date:** Saturday August 10, 2002 @ 04:20 PM
Client: A. Cepas
Contractor: Standard General Inc.
Location: Road Base - 111 Avenue West of 186 Street, 4m South of Centerline.

Station: 1+510 **Depth:** @ Grade **Technician:** Mauro Bagnariol
Material: 20mm Gravel

Dry Density:	2179 **kg/m3**	**Moisture Content:**	5.8%
Proctor Density:	2149 **kg/m3**	**Moisture Content:**	7.1%
Adjusted Proctor Density:	**kg/m3**	**Moisture Content:**	%
% Passing 5mm:	%	**Percent Compaction:**	101.4%

Required Compaction: 100% of a Standard Proctor

REMARKS: Test Section #1, Sample #1.
Standard General 20mm crushed gravel, Inland Pit #45

SUPERVISOR

SO-004

ENGINEER

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Wednesday September 25, 2002

City of Edmonton
Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

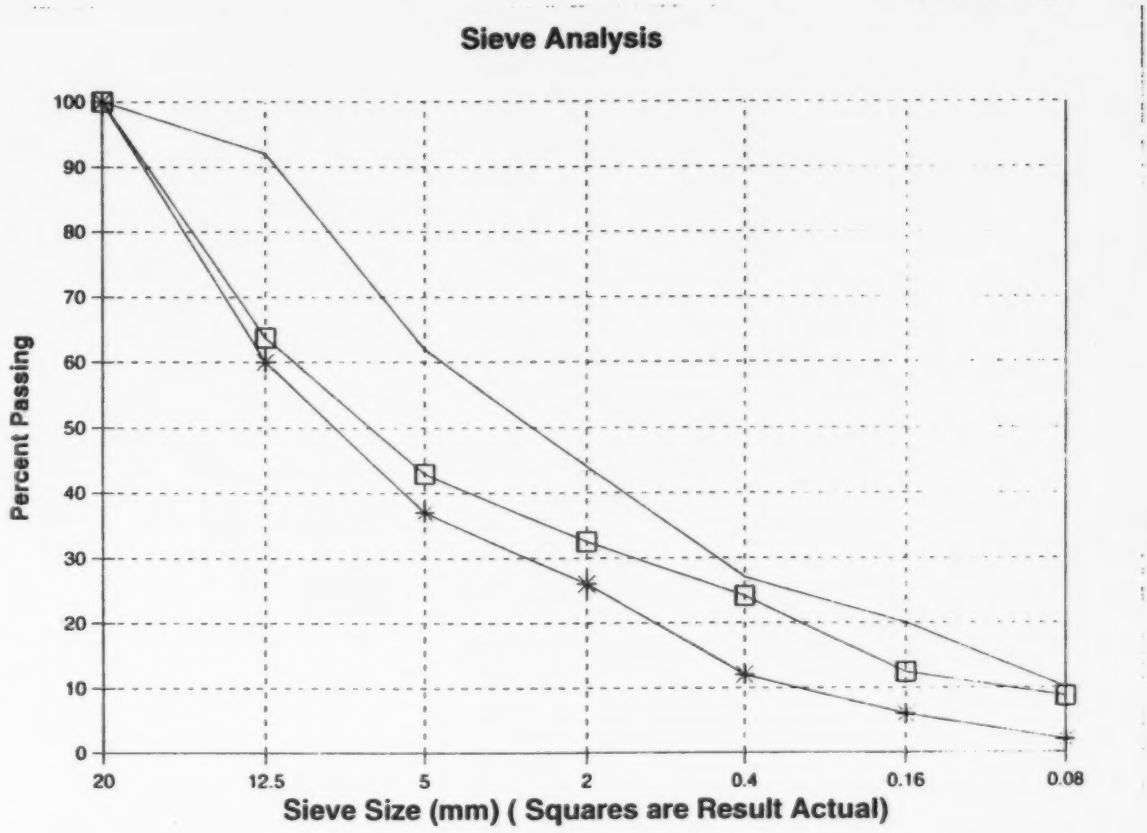
SIEVE ANALYSIS REPORT

Contract Id: **02PW1**
Contractor: **Standard General Inc.**
Description: **Recycled Aggregate Test Section - 111 Avenue, 185 Street to Anthony Henday Drive**
Sample No: **1**
Customer: **A. Cepas**
Technician: **Darryl Aitchison**
Department: **Transportation & Streets**
Material: **Designation 3 Class 20A Gravel**
Location: **Test section @ 111 Avenue, east/Anthony Henday Drive**
Remarks: **Natural gravel from Standard General's Inland Pit #45**

Sample Date Time: **July 25, 2002 @ 9:00 am**

% Moisture: 0.0
% Crush: 54.7

Sieve Size:	Percent Passing:
20	100
12.5	63.7
5	42.9
2	32.5
0.4	24.1
0.16	12.4
0.08	8.7



TECHNICAL SUPERVISOR

AS-002

ENGINEER

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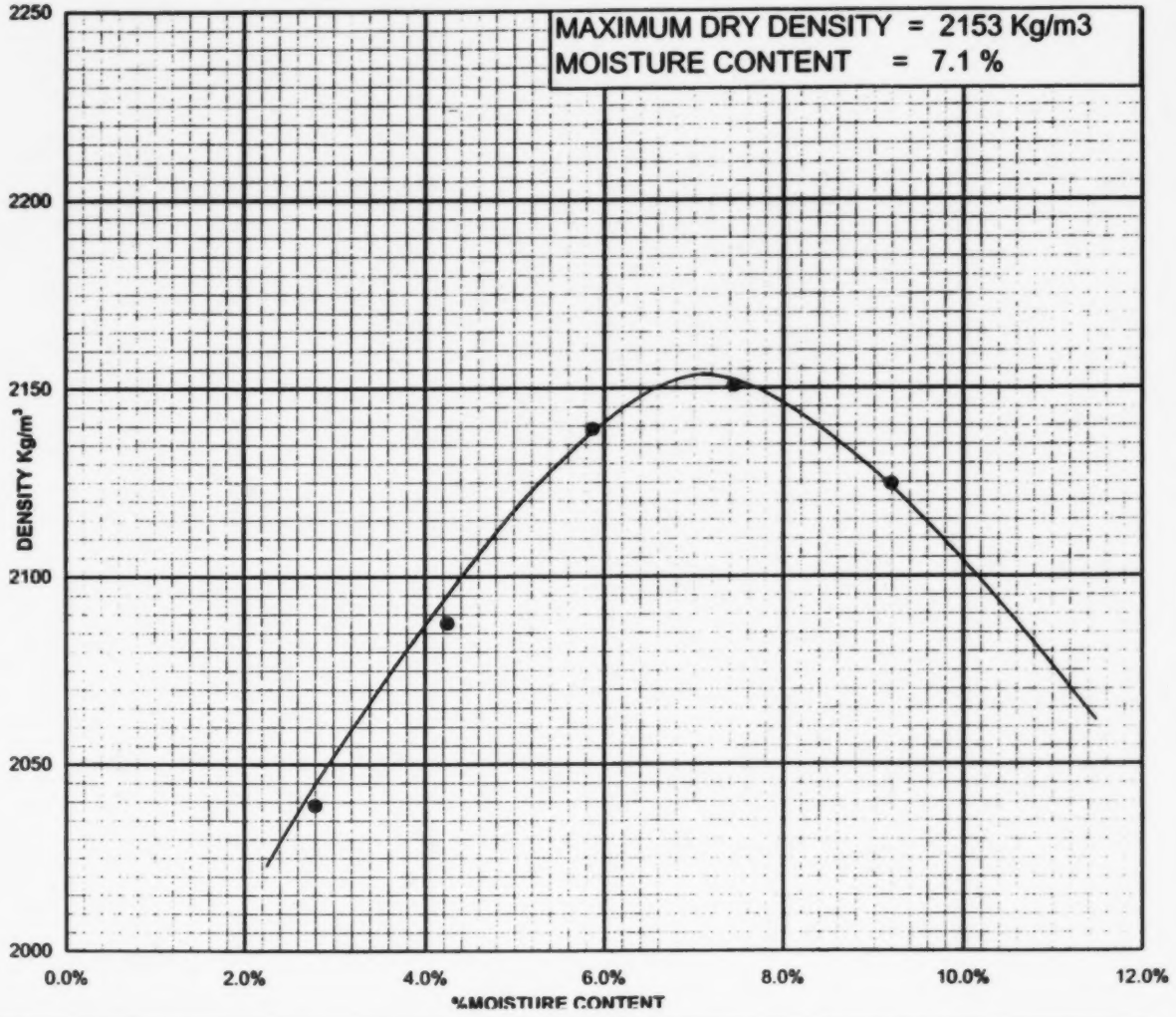
THE CITY OF Edmonton TRANSPORTATION AND STREETS

STANDARD PROCTOR TEST



TRIAL NUMBER	1	2	3	4	5	6	7
MOISTURE CONTENT	2.8%	4.2%	5.9%	7.5%	9.2%		
DRY DENSITY (Kg/m³)	2039	2088	2139	2151	2124		
ATTERBERG LIMITS (%)	L.L.		P.L.		P.I.		

ENGINEER: A. CEPAS	CONTRACT:	CONTRACTOR: STD. GEN.
TECHNICIAN: M.B.	MATERIAL DESCRIPTION: 20MM GRAVEL - STD. GEN. INLAND PIT #45	
LOCATION: RECYCLED AGGREGATE TEST SECTION 111 AVENUE, 185 STREET - ANTHONY HENDAY DRIVE		
DATE TESTED: 2002-07-31	APPROVED BY:	
PROJECT:	TEST HOLE:	DEPTH (M): PLATE #:

Edmonton

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

Monday September 23, 2002

FIELD DENSITY TEST REPORT

Contract ID: AMPW
Contract: 111 Avenue, 186 Street to Anthony Henday Drive
Sample No: 4 **Sample Date:** Wednesday August 07, 2002 @ 04:40 PM
Client: A. Cepas
Contractor: Standard General Inc.
Location: Road Base - 111 Avenue West of 186 Street, 4m South of Centerline.

Station: 1+330 **Depth:** @ Grade **Technician:** Bret Neil
Material: Cement Stabilized Subgrade

Dry Density:	1559 kg/m3	**Moisture Content:**	23.6%
Proctor Density:	1565 kg/m3	**Moisture Content:**	24.3%
Adjusted Proctor Density:	kg/m3	**Moisture Content:**	%
% Passing 5mm:	%	**Percent Compaction:**	99.6%

Required Compaction: 100% of a Standard Proctor

REMARKS: No retests - inspector
*Section 2

SUPERVISOR **ENGINEER**

SO-004

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Edmonton

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

Monday September 23, 2002

FIELD DENSITY TEST REPORT

Contract ID: AMPW
Contract: 111 Avenue, 186 Street to Anthony Henday Drive
Sample No: 10 **Sample Date:** Monday August 19, 2002 @ 05:50 PM
Client: A. Cepas
Contractor: Standard General Inc.
Location: Road Base - North side of intersection of 189 Street and 111 Avenue

Station: 1+288 **Depth:** @ Grade **Technician:** Mauro Bagnariol
Material: Cement Stabilized Subgrade

Dry Density:	1614 kg/m3	**Moisture Content:**	18.6%
Proctor Density:	1598 kg/m3	**Moisture Content:**	23.8%
Adjusted Proctor Density:	kg/m3	**Moisture Content:**	%
% Passing 5mm:	%	**Percent Compaction:**	101.0%

Required Compaction: 100% of a Standard Proctor

REMARKS: Section #2, Sample #1

SUPERVISOR

SO-004

ENGINEER

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Edmonton

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

Monday September 23, 2002

FIELD DENSITY TEST REPORT

Contract ID: AMPW
Contract: 111 Avenue, 186 Street to Anthony Henday Drive
Sample No: 11 **Sample Date:** Monday August 19, 2002 @ 06:05 PM
Client: A. Cepas
Contractor: Standard General Inc.
Location: Road Base - North side of intersection of 189 Street and 111 Avenue, 14m north of south curb

Station: 1+281 **Depth:** @ Grade **Technician:** Mauro Bagnariol
Material: Cement Stabilized Subgrade

Dry Density:	1608 kg/m3	**Moisture Content:**	19.0%
Proctor Density:	1598 kg/m3	**Moisture Content:**	23.8%
Adjusted Proctor Density:	kg/m3	**Moisture Content:**	%
% Passing 5mm:	%	**Percent Compaction:**	100.6%

Required Compaction: 100% of a Standard Proctor

REMARKS: Section #2, Sample #2

SUPERVISOR SO-004 **ENGINEER**

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Edmonton

Monday September 23, 2002

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

FIELD DENSITY TEST REPORT

Contract ID: AMPW
Contract: 111 Avenue, 186 Street to Anthony Henday Drive
Sample No: 12 **Sample Date:** Monday August 19, 2002 @ 06:20 PM
Client: A. Cepas
Contractor: Standard General Inc.
Location: Road Base - South side of 111 Avenue west of 189 Street, 5m north of south curb

Station: 1+236 **Depth:** @ Grade **Technician:** Mauro Bagnariol
Material: Cement Stabilized Subgrade

Dry Density:	1615 kg/m3	**Moisture Content:**	20.0%
Proctor Density:	1625 kg/m3	**Moisture Content:**	23.4%
Adjusted Proctor Density:	kg/m3	**Moisture Content:**	%
% Passing 5mm:	%	**Percent Compaction:**	99.4%

Required Compaction: 100% of a Standard Proctor

REMARKS: Section #2, Sample #3

SUPERVISOR **ENGINEER**

SO-004

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Edmonton

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

Wednesday September 25, 2002

FIELD DENSITY TEST REPORT

Contract ID: AMPW
Contract: 111 Avenue, 186 Street to Anthony Henday Drive
Sample No: 16 **Sample Date:** Wednesday August 28, 2002 @ 03:30 PM
Client: A. Cepas
Contractor: Standard General Inc.
Location: Road Base - Intersection of 111 Avenue and 189 Street

Station: 1+288 **Depth:** @ Grade **Technician:** Allan Herbert
Material: 63mm Gravel

Dry Density:	2086 kg/m3	**Moisture Content:**	3.7%
Proctor Density:	2060 kg/m3	**Moisture Content:**	10.2%
Adjusted Proctor Density:	kg/m3	**Moisture Content:**	%
% Passing 5mm:	%	**Percent Compaction:**	101.3%

Required Compaction: 100% of a Standard Proctor

REMARKS: Section #2, Test #1
Lafarge Cameron Pit (natural 63mm gravel)

SUPERVISOR **ENGINEER**

SD-984

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Edmonton

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

Wednesday September 25, 2002

FIELD DENSITY TEST REPORT

Contract ID: AMPW
Contract: 111 Avenue, 186 Street to Anthony Henday Drive
Sample No: 17 **Sample Date:** Wednesday August 28, 2002 @ 03:40 PM
Client: A. Cepas
Contractor: Standard General Inc.
Location: Road Base - Intersection of 111 Avenue and 189 Street

Station: 1+281 **Depth:** @ Grade **Technician:** Allan Herbert
Material: 63mm Gravel

Dry Density:	2097 kg/m3	**Moisture Content:**	4.4%
Proctor Density:	2060 kg/m3	**Moisture Content:**	10.2%
Adjusted Proctor Density:	kg/m3	**Moisture Content:**	%
% Passing 5mm:	%	**Percent Compaction:**	101.8%

Required Compaction: 100% of a Standard Proctor

REMARKS: Section #2, Test #2
Lafarge Cameron Pit (natural 63mm gravel)

SUPERVISOR **ENGINEER**

SO-004

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Edmonton

Wednesday September 25, 2002

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

FIELD DENSITY TEST REPORT

Contract ID: AMPW
Contract: 111 Avenue, 186 Street to Anthony Henday Drive
Sample No: 18 **Sample Date:** Wednesday August 28, 2002 @ 04:00 PM
Client: A. Cepas
Contractor: Standard General Inc.
Location: Road Base - 111 Avenue west of 189 Street

Station: 1+236 **Depth:** @ Grade **Technician:** Allan Herbert
Material: 63mm Gravel

Dry Density:	2105 kg/m3	**Moisture Content:**	6.3%
Proctor Density:	2060 kg/m3	**Moisture Content:**	10.2%
Adjusted Proctor Density:	kg/m3	**Moisture Content:**	%
% Passing 5mm:	%	**Percent Compaction:**	102.2%

Required Compaction: 100% of a Standard Proctor

REMARKS: Section #2, Test #3
Lafarge Cameron Pit (natural 63mm gravel)

SUPERVISOR **ENGINEER**

SO-004

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Edmonton

Wednesday September 25, 2002

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

SIEVE ANALYSIS REPORT

Contract Id: **02PW1**

Contractor: **Standard General Inc.**

Description: **Recycled Aggregate Test Section - 111 Avenue, 185 Street to Anthony Henday Drive**

Sample No: **2**

Customer: **A. Cepas**

Technician: **Darryl Aitchison**

Department: **Transportation & Streets**

Material: **Designation 3 Class 63B Granular Sub-Base**

Location: **Test section @ 111 Avenue, east/Anthony Henday Drive**

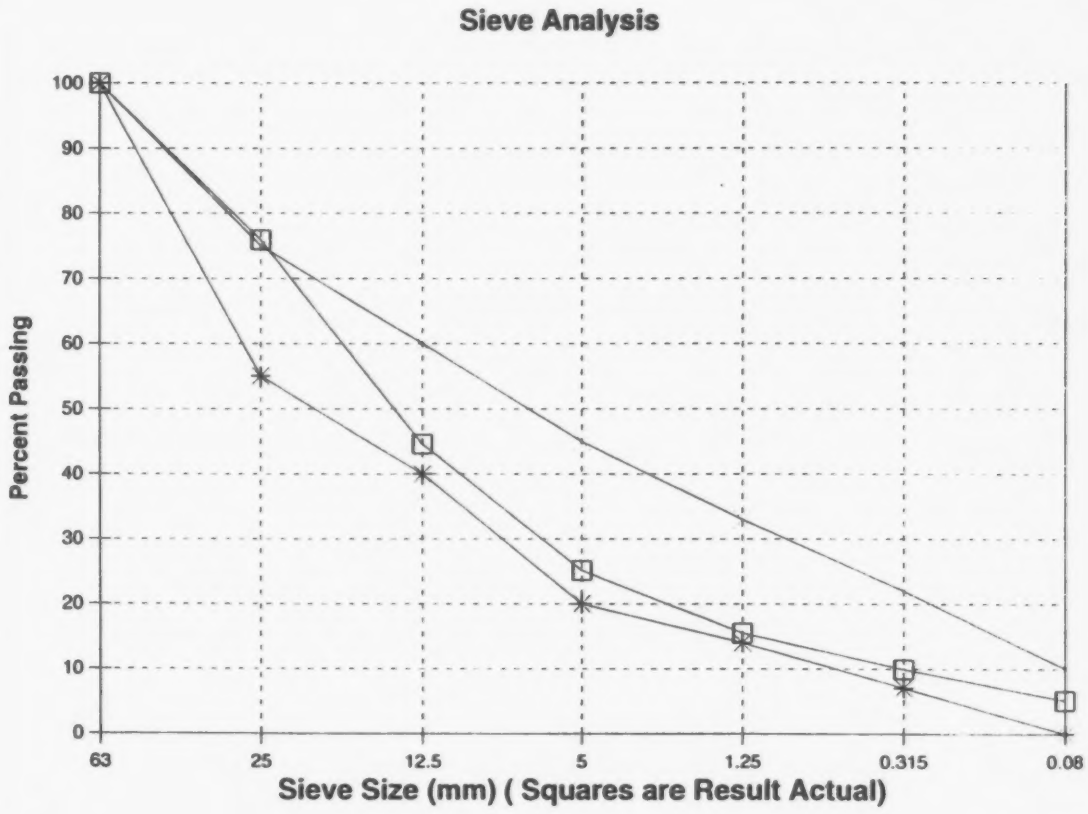
Remarks: **Natural 63 mm gravel from Lafarge Cameron Pit**

Sample Date Time: **July 25, 2002 @ 9:10 am**

% Moisture: 4.0

% Crush:

Sieve Size:	Percent Passing:
63	100
25	75.9
12.5	44.6
5	25.1
1.25	15.5
0.315	9.9
0.08	5.1



TECHNICAL SUPERVISOR

AS-002

ENGINEER

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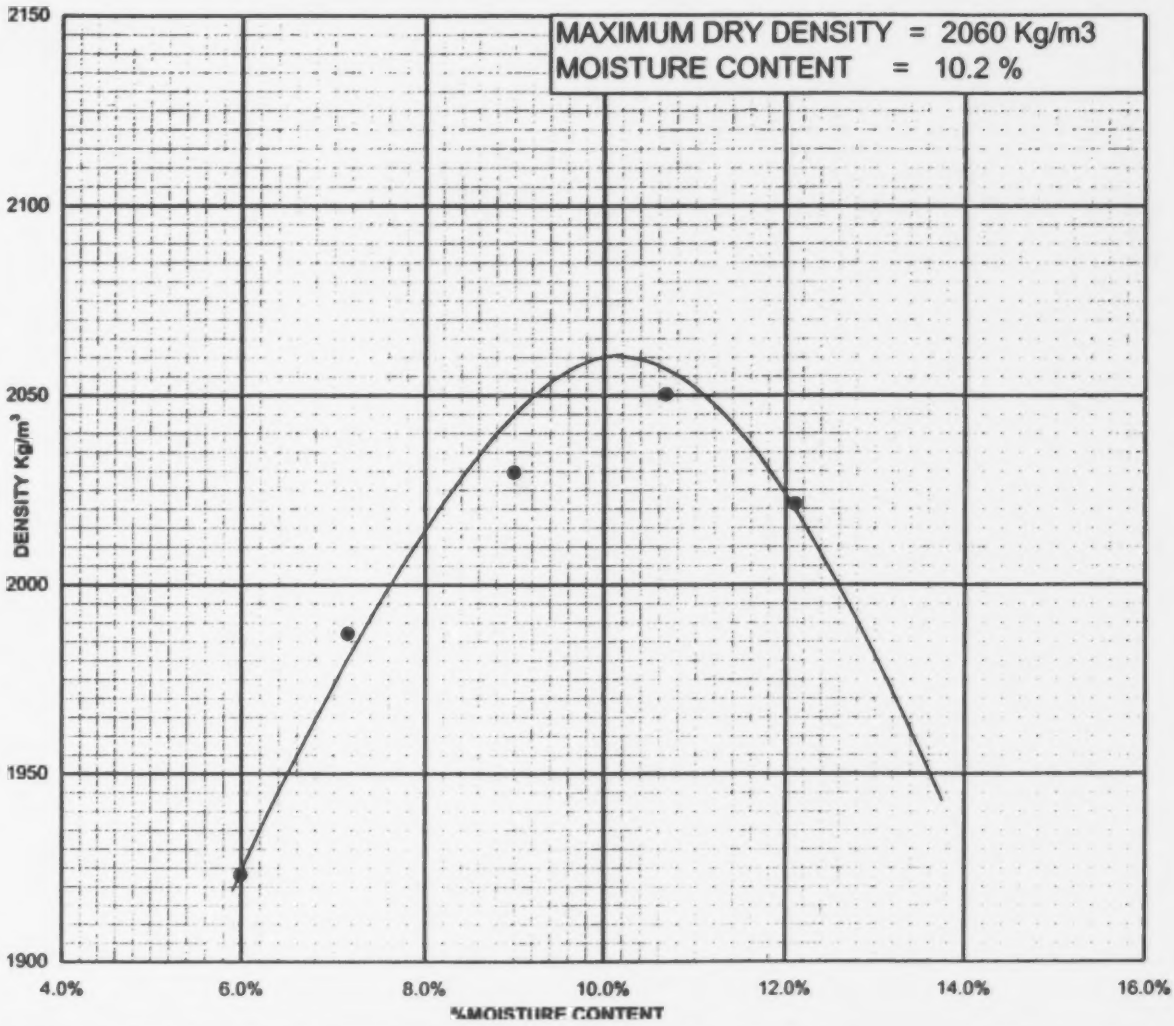
THE CITY OF Edmonton TRANSPORTATION AND STREETS

STANDARD PROCTOR TEST



TRIAL NUMBER	1	2	3	4	5	6	7
MOISTURE CONTENT	6.0%	7.2%	9.0%	10.7%	12.1%		
DRY DENSITY (Kg/m^3)	1923	1987	2030	2050	2021		
ATTERBERG LIMITS (%)	L.L.		P.L.		P.I.		

ENGINEER: A. CEPAS	CONTRACT:	CONTRACTOR: STD. GEN.
TECHNICIAN: M.B.	MATERIAL DESCRIPTION: NAT. 63MM GRAVEL - LAFARGE CAMERON PIT	
LOCATION: RECYCLED AGGREGATE TEST SECTION 111 AVENUE, 185 STREET - ANTHONY HENDAY DRIVE		
DATE TESTED: 2002-08-15	APPROVED BY:	
PROJECT:	TEST HOLE:	DEPTH (M): PLATE #:

Edmonton

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

Monday September 23, 2002

FIELD DENSITY TEST REPORT

Contract ID: AMPW
Contract: 111 Avenue, 186 Street to Anthony Henday Drive
Sample No: 13 **Sample Date:** Friday August 23, 2002 @ 05:15 PM
Client: A. Cepas
Contractor: Standard General Inc.
Location: Road Base - 111 Avenue west of 186 Street, 2m north of centreline

Station: 1+165 **Depth:** @ Grade **Technician:** Bret Neil
Material: Cement Stabilized Subgrade

Dry Density:	1647 kg/m3	**Moisture Content:**	17.5%
Proctor Density:	1641 kg/m3	**Moisture Content:**	21.5%
Adjusted Proctor Density:	kg/m3	**Moisture Content:**	%
% Passing 5mm:	%	**Percent Compaction:**	100.4%

Required Compaction: 100% of a Standard Proctor

REMARKS: Section #3, Test #2

SUPERVISOR **ENGINEER**

SO-004

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Monday September 23, 2002

Edmonton

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

FIELD DENSITY TEST REPORT

Contract ID: AMPW
Contract: 111 Avenue, 186 Street to Anthony Henday Drive
Sample No: 15 **Sample Date:** Saturday August 24, 2002 @ 04:25 PM
Client: A. Cepas
Contractor: Standard General Inc.
Location: Road Base - 111 Avenue west of 186 Street, 4m north of centreline

Station: 1+080 **Depth:** @ Grade **Technician:** Bret Neil
Material: Cement Stabilized Subgrade

Dry Density:	1656 kg/m3	**Moisture Content:**	17.1%
Proctor Density:	1649 kg/m3	**Moisture Content:**	21.8%
Adjusted Proctor Density:	kg/m3	**Moisture Content:**	%
% Passing 5mm:	%	**Percent Compaction:**	100.4%

Required Compaction: 100% of a Standard Proctor

REMARKS: Section #3, Test #3

SUPERVISOR

SO-004

ENGINEER

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Wednesday September 25, 2002

Edmonton

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

FIELD DENSITY TEST REPORT

Contract ID: AMPW
Contract: 111 Avenue, 186 Street to Anthony Henday Drive
Sample No: 19 **Sample Date:** Friday August 30, 2002 @ 09:05 AM
Client: A. Cepas
Contractor: Standard General Inc.
Location: Road Base - 111 Avenue west of 189 Street, north side

Station: 1+190 **Depth:** @ Grade **Technician:** Mauro Bagnariol
Material: 63 mm Recycled Aggregate

Dry Density:	1992 **kg/m3**	**Moisture Content:**	7.1%
Proctor Density:	1955 **kg/m3**	**Moisture Content:**	10.2%
Adjusted Proctor Density:	**kg/m3**	**Moisture Content:**	%
% Passing 5mm:	%	**Percent Compaction:**	101.9%

Required Compaction: 100% of a Standard Proctor

REMARKS: Section #3, Test #1
*City 63mm Recycled Aggregate

SUPERVISOR

ENGINEER

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Wednesday September 25, 2002

Edmonton

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

FIELD DENSITY TEST REPORT

Contract ID: AMPW
Contract: 111 Avenue, 186 Street to Anthony Henday Drive
Sample No: 20 **Sample Date:** Friday August 30, 2002 @ 09:15 AM
Client: A. Cepas
Contractor: Standard General Inc.
Location: Road Base - 111 Avenue west of 189 Street, south side

Station: 1+120 **Depth:** @ Grade **Technician:** Mauro Bagnariol
Material: 63 mm Recycled Aggregate

Dry Density:	1957 kg/m3	**Moisture Content:**	5.2%
Proctor Density:	1955 kg/m3	**Moisture Content:**	10.2%
Adjusted Proctor Density:	kg/m3	**Moisture Content:**	%
% Passing 5mm:	%	**Percent Compaction:**	100.1%

Required Compaction: 100% of a Standard Proctor

REMARKS: Section #3, Test #2
*City 63mm Recycled Aggregate

SUPERVISOR

SO-004

ENGINEER

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Wednesday September 25, 2002

Edmonton

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

FIELD DENSITY TEST REPORT

Contract ID: AMPW
Contract: 111 Avenue, 186 Street to Anthony Henday Drive
Sample No: 21 **Sample Date:** Friday August 30, 2002 @ 09:35 AM
Client: A. Cepas
Contractor: Standard General Inc.
Location: Road Base - 111 Avenue west of 189 Street, north side

Station: 1+060 **Depth:** @ Grade **Technician:** Mauro Bagnariol
Material: 63 mm Recycled Aggregate

Dry Density:	1961 kg/m3	**Moisture Content:**	6.1%
Proctor Density:	1955 kg/m3	**Moisture Content:**	10.2%
Adjusted Proctor Density:	kg/m3	**Moisture Content:**	%
% Passing 5mm:	%	**Percent Compaction:**	100.3%

Required Compaction: 100% of a Standard Proctor

REMARKS: Section #3, Test #3
*City 63mm Recycled Aggregate

SUPERVISOR

SO-004

ENGINEER

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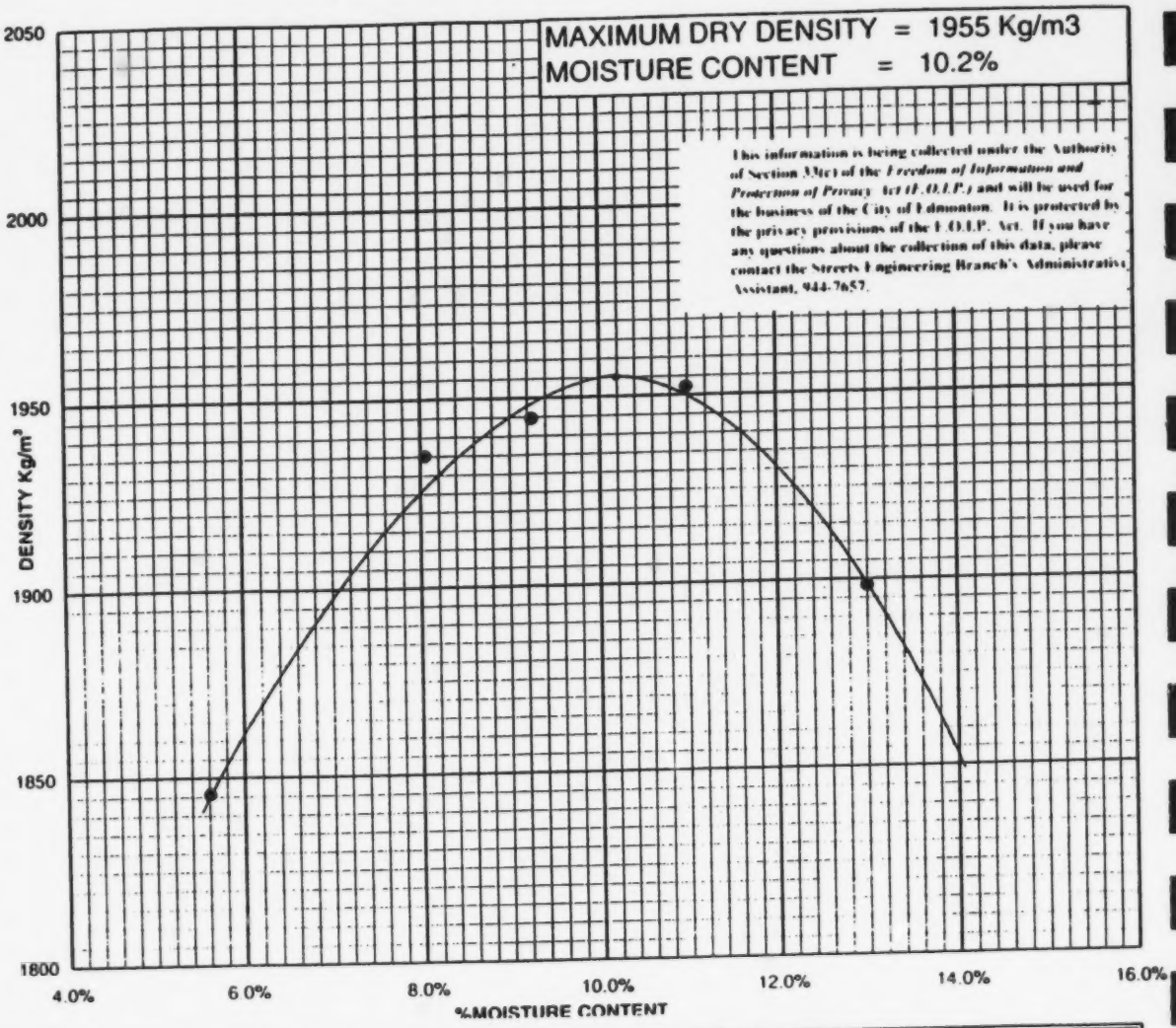
THE CITY OF Edmonton TRANSPORTATION AND STREETS

STANDARD PROCTOR TEST


MAXIMUM DRY DENSITY = 1955 Kg/m3
MOISTURE CONTENT = 10.2%
This information is being collected under the Authority of Section 33(c) of the Freedom of Information and Protection of Privacy Act (F.O.I.P.) and will be used for the business of the City of Edmonton. It is protected by the privacy provisions of the F.O.I.P. Act. If you have any questions about the collection of this data, please contact the Streets Engineering Branch's Administrative Assistant, 944-7657.
2050
2000
1950
1900
1850
1800
DENSITY Kg/m3
4.0%
6.0%
8.0%
10.0%
12.0%
14.0%
16.0%
%MOISTURE CONTENT

TRIAL NUMBER	1	2	3	4	5	6	7
MOISTURE CONTENT	5.6%	8.1%	9.2%	11.0%	13.0%		
DRY DENSITY (Kg/m^3)	1846	1935	1945	1952	1898		
ATTERBERG LIMITS (%)	L.L.		P.L.		P.I.		

ENGINEER: M. MacIsaac	CONTRACT:	CONTRACTOR: Streamline Const.
TECHNICIAN: M.B.	MATERIAL DESCRIPTION: City 63mm. Recycle	
LOCATION: 2002 Waterline Replacement - Cont. #1		
DATE TESTED: 2002-05-13	APPROVED BY:	
PROJECT:	TEST HOLE:	DEPTH (M): PLATE #:

THE CITY OF Edmonton TRANSPORTATION AND STREETS

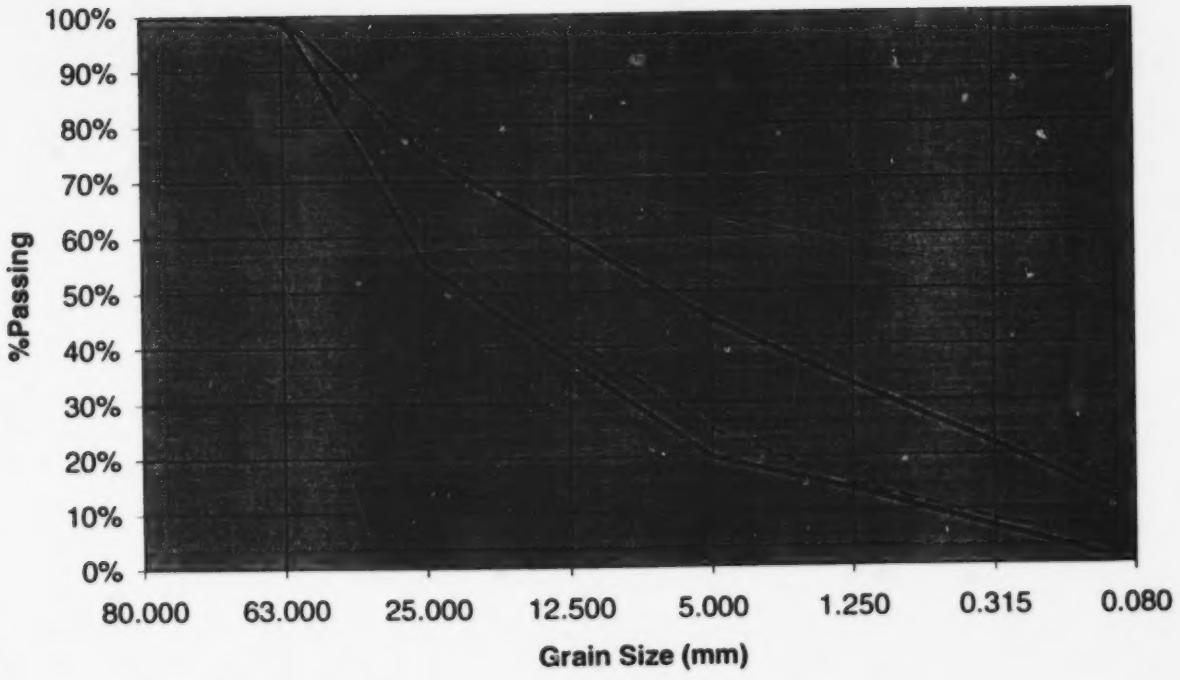
SIEVE ANALYSIS REPORT

DATE : 02-Oct-02 **MATERIAL:** Average Grading for Crushed Concrete

SUPPLIER: City of Edmonton 184 Street & 107 Avenue Recycling Plant

Sieve Size	%Passing
80.000 mm	100.0%
63.000 mm	98.9%
25.000 mm	60.8%
12.500 mm	42.3%
5.000 mm	25.0%
1.250 mm	15.0%
0.315 mm	8.2%
0.080 mm	3.6%

Sieve Analysis



Technical Supervisor _____

Engineer _____

Edmonton

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

SIEVE SUMMARY REPORT

For Contract: 02CC2
Sample Range 1 to 28

Wednesday Oct 02, 2002
AS-007

Contract ID: 02CC2
Contract: 184 Street Recycling Plant
Contractor: City of Edmonton
Material : 63 mm Recycled Aggregate
Branch: 66 - Technical Services
Client: J. Mundy

Sieve % Passing (mm) 63.0	25.0	12.5	10.0	5.0	1.25	.315	.080
Sample #: 1	**Date:** 05/28/2002			**Project:** 24271			
100.0	65.2	53.0	100.0	25.9	15.7	8.1	3.1
Sample #: 2	**Date:** 05/30/2002			**Project:** 24271			
100.0	71.0	43.1		25.4	16.5	9.3	4.2
Sample #: 3	**Date:** 06/04/2002			**Project:** 24271			
100.0	63.5	43.8		24.4	12.7	5.4	1.4
Sample #: 4	**Date:** 06/02/2002			**Project:** 24271			
100.0	75.7	50.9		27.8	16.7	9.1	3.8
Sample #: 5	**Date:** 06/17/2002			**Project:** 24271			
100.0	73.0	54.8		32.3	20.0	11.0	4.8
Sample #: 6	**Date:** 06/21/2002			**Project:** 24271			
100.0	70.7	48.8		30.8	21.4	11.5	3.9
Sample #: 7	**Date:** 06/25/2002			**Project:** 24271			
100.0	77.5	52.8		26.0	14.3	6.7	3.0
Sample #: 8	**Date:** 06/27/2002			**Project:** 24271			
100.0	60.6	43.5		25.2	15.0	8.7	4.7
Sample #: 9	**Date:** 07/03/2002			**Project:** 24271			
100.0	59.8	38.6		21.0	11.9	6.1	1.9
Sample #: 10	**Date:** 07/05/2002			**Project:** 24271			
100.0	58.1	41.9		25.0	14.9	7.5	2.4
Sample #: 11	**Date:** 07/11/2002			**Project:** 24271			
100.0	64.6	45.4		24.2	13.8	6.8	2.3
Sample #: 12	**Date:** 07/15/2002			**Project:** 24271			
100.0	63.8	41.5		26.3	17.5	10.7	5.6
Sample #: 13	**Date:** 07/18/2002			**Project:** 24271			
100.0	64.8	43.3		23.2	15.3	9.3	4.1
Sample #: 14	**Date:** 07/25/2002			**Project:** 24271			
100.0	57.2	38.4		20.2	11.1	4.9	1.5
Sample #: 15	**Date:** 07/30/2002			**Project:** 24271			
100.0	50.4	32.3		18.1	11.5	7.1	4.0
Sample #: 16	**Date:** 08/02/2002			**Project:** 24271			
100.0	62.3	46.3		26.2	14.7	6.3	5.3

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Edmonton
Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

SIEVE SUMMARY REPORT

For Contract: 02CC2
Sample Range 1 to 28

Contract ID: 02CC2
Contract: 184 Street Recycling Plant
Contractor: City of Edmonton
Material : 63 mm Recycled Aggregate
Branch: 66 - Technical Services
Client: J. Mundy

Sieve % Passing (mm) 63.0	25.0	12.5	5.0	1.25	.315	.080
Sample #: 17	**Date:** 08/06/2002	**Project:** 24271				
100.0	55.9	38.0	22.1	14.9	9.3	4.3
Sample #: 18	**Date:** 08/19/2002	**Project:** 24271				
100.0	63.5	46.3	27.2	17.2	10.4	4.9
Sample #: 19	**Date:** 08/21/2002	**Project:** 24271				
100.0	60.9	36.5	16.9	7.8	3.8	1.4
Sample #: 20	**Date:** 08/26/2002	**Project:** 24271				
100.0	57.9	40.3	24.2	15.2	8.8	3.7
Sample #: 21	**Date:** 08/29/2002	**Project:** 24271				
100.0	56.1	40.7	24.2	16.3	11.0	6.5
Sample #: 22	**Date:** 09/10/2002	**Project:** 24271				
100.0	48.5	31.3	17.6	9.3	4.2	1.2
Sample #: 23	**Date:** 09/12/2002	**Project:** 24271				
100.0	53.9	38.2	22.8	12.5	8.5	4.7
Sample #: 24	**Date:** 09/17/2002	**Project:** 24271				
100.0	67.4	51.1	33.2	21.1	11.4	4.6
Sample #: 25	**Date:** 09/19/2002	**Project:** 24271				
87.5	64.7	44.7	27.0	16.8	8.8	3.3
Sample #: 26	**Date:** 09/24/2002	**Project:** 24271				
100.0	76.5	55.0	33.2	18.2	6.2	1.8
Sample #: 27	**Date:** 09/26/2002	**Project:** 24271				
100.0	64.3	41.7	23.2	14.0	7.6	3.1
Sample #: 28	**Date:** 09/30/2002	**Project:** 24271				
100.0	56.3	40.0	25.5	17.1	9.7	3.9
98.9	60.8	42.3	25.0	15.0	8.2	3.6

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Edmonton

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

Monday September 23, 2002

FIELD DENSITY TEST REPORT

Contract ID: AMPW
Contract: 111 Avenue, 186 Street to Anthony Henday Drive
Sample No: 23 **Sample Date:** Sunday September 01, 2002 @ 01:10 PM
Client: A. Cepas
Contractor: Standard General Inc.
Location: Road Base - 111 Avenue west of 189 Street, 9.4m south of north curb

Station: 938 **Depth:** @ Grade **Technician:** Mauro Bagnariol
Material: Cement Stabilized Subgrade

Dry Density:	1518 kg/m3	**Moisture Content:**	25.3%
Proctor Density:	1513 kg/m3	**Moisture Content:**	26.4%
Adjusted Proctor Density:	kg/m3	**Moisture Content:**	%
% Passing 5mm:	%	**Percent Compaction:**	100.3%

Required Compaction: 100% of a Standard Proctor

REMARKS: Section #4, Test #2

SUPERVISOR

SD-004

ENGINEER

This information is being collected under the Authority of Section 33(c) of the Freedom of Information and Protection of Privacy Act (F.O.I.P.) and will be used for the business of the City of Edmonton. It is protected by the privacy provisions of the F.O.I.P. Act. If you have any questions about the collection of this data, please contact the Streets Engineering Branch's Administrative Assistant 944-7657.

Edmonton

Monday September 23, 200

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

FIELD DENSITY TEST REPORT

Contract ID: AMPW
Contract: 111 Avenue, 186 Street to Anthony Henday Drive
Sample No: 24 **Sample Date:** Sunday September 01, 2002 @ 02:30 PM
Client: A. Cepas
Contractor: Standard General Inc.
Location: Road Base - 111 Avenue west of 189 Street, 13m south of north curb

Station: 884 **Depth:** @ Grade **Technician:** Mauro Bagnaricl
Material: Cement Stabilized Subgrade

Dry Density:	1538 kg/m3	**Moisture Content:**	23.5%
Proctor Density:	1510 kg/m3	**Moisture Content:**	25.9%
Adjusted Proctor Density:	kg/m3	**Moisture Content:**	%
% Passing 5mm:	%	**Percent Compaction:**	101.9%

Required Compaction: 100% of a Standard Proctor

REMARKS: Section #4, Test #3

SUPERVISOR SO-004 **ENGINEER**

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Wednesday September 25, 2002

Edmonton

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

FIELD DENSITY TEST REPORT

Contract ID: AMPW
Contract: 111 Avenue, 186 Street to Anthony Henday Drive
Sample No: 27 **Sample Date:** Thursday September 05, 2002 @ 11:15 AM
Client: A. Cepas
Contractor: Standard General Inc.
Location: Road Base - 111 Avenue west of 189 Street, 4m south of north curb

Station: 972 **Depth:** @ Grade **Technician:** Mauro Bagnariol
Material: 63 mm Recycled Aggregate

Dry Density:	1984 kg/m3	**Moisture Content:**	8.4%
Proctor Density:	1955 kg/m3	**Moisture Content:**	10.2%
Adjusted Proctor Density:	kg/m3	**Moisture Content:**	%
% Passing 5mm:	%	**Percent Compaction:**	101.5%

Required Compaction: 100% of a Standard Proctor

REMARKS: Section #4, Test #1
City 63mm Recycled Aggregate

SUPERVISOR

SO-004

ENGINEER

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Wednesday September 25, 2002

Edmonton

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

FIELD DENSITY TEST REPORT

Contract ID: AMPW
Contract: 111 Avenue, 186 Street to Anthony Henday Drive
Sample No: 28 **Sample Date:** Thursday September 05, 2002 @ 11:35 AM
Client: A. Cepas
Contractor: Standard General Inc.
Location: Road Base - 111 Avenue west of 189 Street, 9m south of north curb

Station: 938 **Depth:** @ Grade **Technician:** Mauro Bagnariol
Material: 63 mm Recycled Aggregate

Dry Density:	1947 kg/m3	**Moisture Content:**	6.2%
Proctor Density:	1955 kg/m3	**Moisture Content:**	10.2%
Adjusted Proctor Density:	kg/m3	**Moisture Content:**	%
% Passing 5mm:	%	**Percent Compaction:**	99.6%

Required Compaction: 100% of a Standard Proctor

REMARKS: Section #4, Test #2
*City 63mm Recycled Aggregate

SUPERVISOR **ENGINEER**

SO-004

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Wednesday September 25, 2002

Edmonton

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

FIELD DENSITY TEST REPORT

Contract ID: AMPW
Contract: 111 Avenue, 186 Street to Anthony Henday Drive
Sample No: 29 **Sample Date:** Thursday September 05, 2002 @ 01:25 PM
Client: A. Cepas
Contractor: Standard General Inc.
Location: Road Base - 111 Avenue west of 189 Street, 13m south of north curb

Station: 883 **Depth:** @ Grade **Technician:** Mauro Bagnariol
Material: 63 mm Recycled Aggregate

Dry Density:	1943 kg/m3	**Moisture Content:**	7.1%
Proctor Density:	1955 kg/m3	**Moisture Content:**	10.2%
Adjusted Proctor Density:	kg/m3	**Moisture Content:**	%
% Passing 5mm:	%	**Percent Compaction:**	99.4%

Required Compaction: 100% of a Standard Proctor

REMARKS: Section #4, Test #3
*City 63mm Recycled Aggregate

SUPERVISOR

ENGINEER

SG-004

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Monday September 23, 2002

Edmonton

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

FIELD DENSITY TEST REPORT

Contract ID: AMPW
Contract: 111 Avenue, 186 Street to Anthony Henday Drive
Sample No: 14 **Sample Date:** Saturday August 24, 2002 @ 04:00 PM
Client: A. Cepas
Contractor: Standard General Inc.
Location: Road Base - 111 Avenue west of 186 Street, 5m south of centreline

Station: 1+020 **Depth:** @ Grade **Technician:** Bret Neil
Material: Cement Stabilized Subgrade

Dry Density:	1541 kg/m3	**Moisture Content:**	20.1%
Proctor Density:	1536 kg/m3	**Moisture Content:**	25.8%
Adjusted Proctor Density:	kg/m3	**Moisture Content:**	%
% Passing 5mm:	%	**Percent Compaction:**	100.3%

Required Compaction: 100% of a Standard Proctor

REMARKS: Section #4

SUPERVISOR

SO-004

ENGINEER

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Monday September 23, 2002

Edmonton

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

FIELD DENSITY TEST REPORT

Contract ID: AMPW
Contract: 111 Avenue, 186 Street to Anthony Henday Drive
Sample No: 22 **Sample Date:** Sunday September 01, 2002 @ 12:45 PM
Client: A. Cepas
Contractor: Standard General Inc.
Location: Road Base - 111 Avenue west of 189 Street, 4m south of north curb

Station: 972 **Depth:** @ Grade **Technician:** Mauro Bagnariol
Material: Cement Stabilized Subgrade

Dry Density:	1545 kg/m3	**Moisture Content:**	23.6%
Proctor Density:	1530 kg/m3	**Moisture Content:**	26.8%
Adjusted Proctor Density:	kg/m3	**Moisture Content:**	%
% Passing 5mm:	%	**Percent Compaction:**	101.0%

Required Compaction: 100% of a Standard Proctor

REMARKS: Section #4, test #1

SUPERVISOR **ENGINEER**

SO-004

The information is being collected under the Authority of Section 33(c) of the Freedom of Information and Protection of Privacy Act (F.O.I.P.) and will be used for the business of the City of Edmonton. It is protected by the privacy provisions of the F.O.I.P. Act. If you have any questions about the collection of this data, please contact the Streets Engineering Branch's Administrative Assistant, 944-7651.

Wednesday September 25, 2002

Edmonton

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

FIELD DENSITY TEST REPORT

Contract ID: AMPW
Contract: 111 Avenue, 186 Street to Anthony Henday Drive
Sample No: 25 **Sample Date:** Sunday September 01, 2002 @ 04:30 PM
Client: A. Cepas
Contractor: Standard General Inc.
Location: Road Base - 111 Avenue west of 189 Street, 8m south of north curb

Station: 763 **Depth:** @ Grade **Technician:** Mauro Bagnariol
Material: Cement Stabilized Subgrade

Dry Density:	1571 kg/m3	**Moisture Content:**	23.0%
Proctor Density:	1577 kg/m3	**Moisture Content:**	25.4%
Adjusted Proctor Density:	kg/m3	**Moisture Content:**	%
% Passing 5mm:	%	**Percent Compaction:**	99.6%

Required Compaction: 100% of a Standard Proctor

REMARKS: Section #5, Test #2

SUPERVISOR **ENGINEER**

SO-004

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Monday September 23, 2002

Edmonton

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

FIELD DENSITY TEST REPORT

Contract ID: AMPW
Contract: 111 Avenue, 186 Street to Anthony Henday Drive
Sample No: 26 **Sample Date:** Sunday September 01, 2002 @ 05:10 PM
Client: A. Cepas
Contractor: Standard General Inc.
Location: Road Base - 111 Avenue west of 189 Street, 12m south of north curb

Station: 720 **Depth:** @ Grade **Technician:** Mauro Bagnariol
Material: Cement Stabilized Subgrade

Dry Density:	1627 kg/m3	**Moisture Content:**	20.1%
Proctor Density:	1600 kg/m3	**Moisture Content:**	21.8%
Adjusted Proctor Density:	kg/m3	**Moisture Content:**	%
% Passing 5mm:	%	**Percent Compaction:**	101.7%

Required Compaction: 100% of a Standard Proctor

REMARKS: Section #5, Test #3

SUPERVISOR **ENGINEER**

SO-004

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Wednesday September 25, 2002

Edmonton

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

FIELD DENSITY TEST REPORT

Contract ID: AMPW
Contract: 111 Avenue, 186 Street to Anthony Henday Drive
Sample No: 30 **Sample Date:** Thursday September 05, 2002 @ 01:40 PM
Client: A. Cepas
Contractor: Standard General Inc.
Location: Road Base - 111 Avenue west of 189 Street, 8m south of north curb

Station: 762 **Depth:** @ Grade **Technician:** Mauro Bagnariol
Material: 63 mm Recycled Aggregate

Dry Density:	1941 kg/m3	**Moisture Content:**	5.2%
Proctor Density:	1955 kg/m3	**Moisture Content:**	10.2%
Adjusted Proctor Density:	kg/m3	**Moisture Content:**	%
% Passing 5mm:	%	**Percent Compaction:**	99.3%

Required Compaction: 100% of a Standard Proctor

REMARKS: Section #5, Test #2
*City 63mm Recycled Aggregate

SUPERVISOR **ENGINEER**

SO-004

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Wednesday September 25, 2002

Edmonton

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

FIELD DENSITY TEST REPORT

Contract ID: AMPW
Contract: 111 Avenue, 186 Street to Anthony Henday Drive
Sample No: 31 **Sample Date:** Thursday September 05, 2002 @ 01:55 PM
Client: A. Cepas
Contractor: Standard General Inc.
Location: Road Base - 111 Avenue west of 189 Street, 12m south of north curb

Station: 720 **Depth:** @ Grade **Technician:** Mauro Bagnariol
Material: 63 mm Recycled Aggregate

Dry Density:	1943 kg/m3	**Moisture Content:**	7.2%
Proctor Density:	1955 kg/m3	**Moisture Content:**	10.2%
Adjusted Proctor Density:	kg/m3	**Moisture Content:**	%
% Passing 5mm:	%	**Percent Compaction:**	99.4%

Required Compaction: 100% of a Standard Proctor

REMARKS: City 63mm Recycled Aggregate, no retests - inspector
*Section #5, Test #3

SUPERVISOR **ENGINEER**

SO-004

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Edmonton

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

MARSHALL TEST REPORT

Project ID: 35809

Contract ID: 02PW1

Contract: Recycled Aggregate Test Section - 111 Avenue, 185 Street to Anthony Henday Drive

Sample No: 1 **Contractor:** Standard General Inc.

Sample Date: Aug/30/2002 12:20 PM **Sub Contractor:**

Technician: Darryl Aitchison **Client:** A. Cepas

Asphalt Type: ACB **Department:** Transportation & Streets

Location: 1st lift/1st mat S/N edge/111 Avenue ~25 m W/189 Street

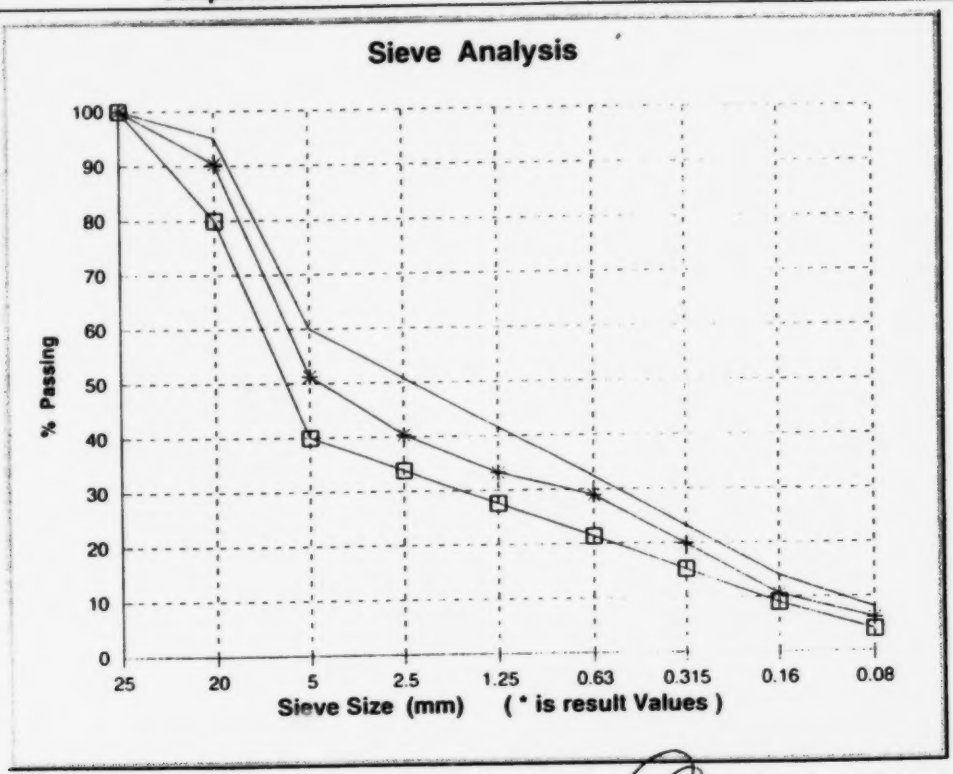
Remarks:

Specific Gravity: 2.355
Theor. Spec. Gravity: 2.461
% Void: 4.3
% Void Filled: 68.5
Stability: 12,747
Flow: 9.2

% Extracted Bitumen: 4.7
% Design Bitumen: 4.9
Film Thickness: 6.4
% Crush: 90.7
Temp. **Field :** 155
Lab : 150
Compaction : 150

	Core	Re-core
Ac Thickness:	52.0	69.0
% Compaction:	94.9	97.0
% Compaction Req:	97.0	97.0

Sieve Size (mm)	% Passing
25.000	100.0
20.000	90.3
5.000	51.3
2.500	40.4
1.250	33.3
0.630	28.9
0.315	19.9
0.160	10.6
0.080	6.1



TECHNICAL SUPERVISOR

A5-003

ENGINEER

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MARSHALL TEST REPORT

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

Project ID: 35809

Contract ID: 02PW1

Contract: Recycled Aggregate Test Section - 111 Avenue, 185 Street to Anthony Henday Drive

Sample No: 2 **Contractor:** Standard General Inc.

Sample Date: Sep/06/2002 09:00 AM **Sub Contractor:**

Technician: Dean Upright **Client:** A. Cepas

Asphalt Type: ACB **Department:** Transportation & Streets

Location: 1st lift/1st mat S/N edge/111 Avenue
-420 m W/190 Street

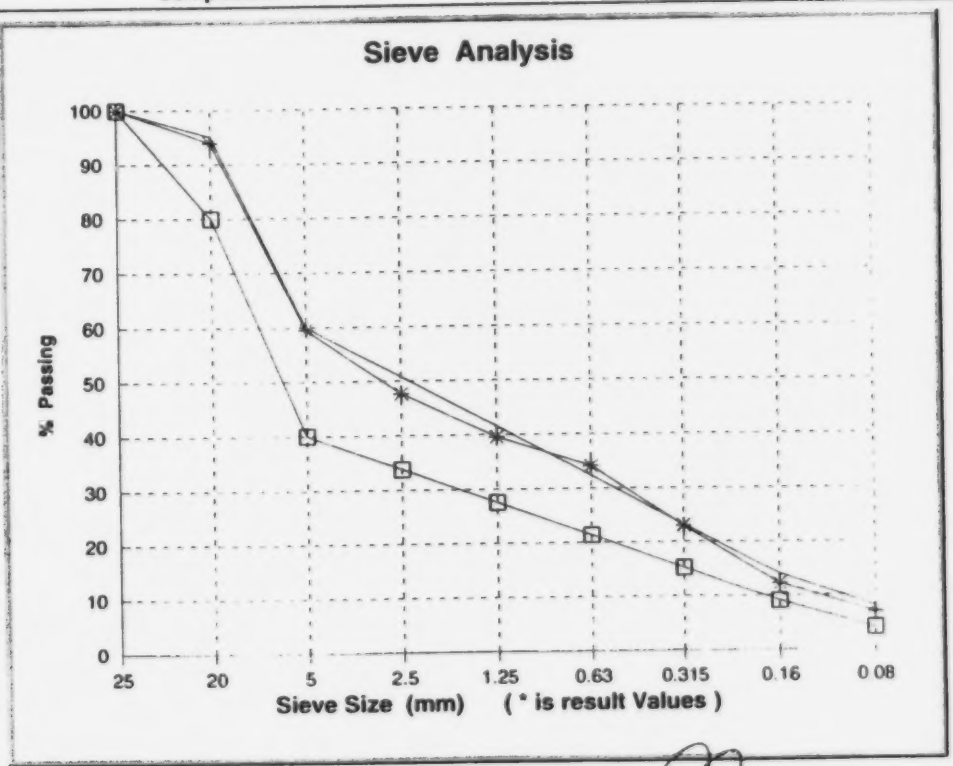
Remarks:

Specific Gravity: 2.352
Theor. Spec. Gravity: 2.448
% Void: 3.9
% Void Filled: 72.5
Stability: 13,348
Flow: 8.7

% Extracted Bitumen: 5.1
% Design Bitumen: 4.9
Film Thickness: 6.2
% Crush: 96.1
Temp. **Field :** 150
Lab : 140
Compaction : 140

	Core	Re-core
Ac Thickness:	73.0	
% Compaction:	98.1	
% Compaction Req:	97.0	

Sieve Size (mm)	% Passing
25.000	100.0
20.000	93.9
5.000	59.5
2.500	47.7
1.250	39.6
0.630	34.1
0.315	23.0
0.160	12.2
0.080	6.9



TECHNICAL SUPERVISOR

ENGINEER

AS-003

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Edmonton

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

MARSHALL TEST REPORT

Project ID: 35809

Contract ID: 02PW1

Contract: Recycled Aggregate Test Section - 111 Avenue, 185 Street to Anthony Henday Drive

Sample No: 3 **Contractor:** Standard General Inc.

Sample Date: Sep/06/2002 12:40 PM **Sub Contractor:**

Technician: Dean Upright **Client:** A. Cepas

Asphalt Type: ACB **Department:** Transportation & Streets

Location: 1st lift/centre mat/111 Avenue ~140 m W/190 Street

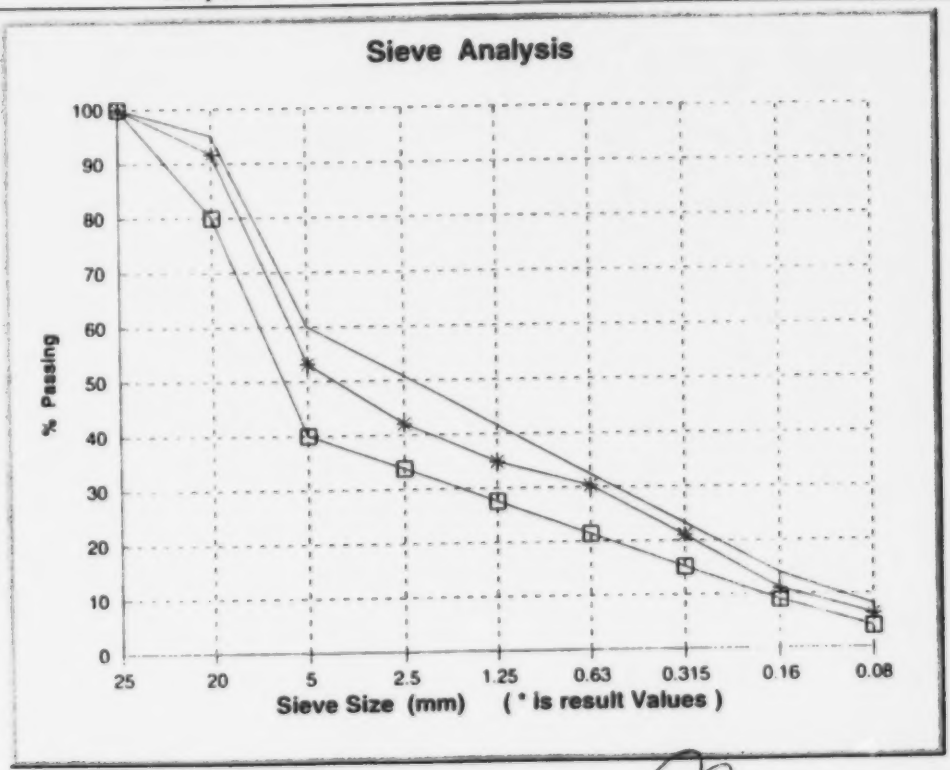
Remarks:

Specific Gravity: 2.338
Theor. Spec. Gravity: 2.462
% Void: 5.0
% Void Filled: 64.8
Stability: 12,239
Flow: 7.8

% Extracted Bitumen: 4.6
% Design Bitumen: 4.9
Film Thickness: 6.1
% Crush: 91.1
Temp. **Field :** 1351
Lab : 130
Compaction : 130

	Core	Re-core
Ac Thickness:	70.0	
% Compaction:	97.1	
% Compaction Req:	97.0	

Sieve Size (mm)	% Passing
25.000	100.0
20.000	91.7
5.000	53.2
2.500	42.1
1.250	34.9
0.630	30.3
0.315	21.0
0.160	11.1
0.080	6.3



TECHNICAL SUPERVISOR

AS-003

ENGINEER

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Edmonton

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

MARSHALL TEST REPORT

Project ID: 35809

Contract ID: 02PW1

Contract: Recycled Aggregate Test Section - 111 Avenue, 185 Street to Anthony Henday Drive

Sample No: 4 **Contractor:** Standard General Inc.

Sample Date: Sep/07/2002 07:30 AM **Sub Contractor:**

Technician: Dean Upright **Client:** A. Cepas

Asphalt Type: ACO **Department:** Transportation & Streets

Location: Toplift/1st mat S/N curb/111 Avenue -2 m W/186 Street

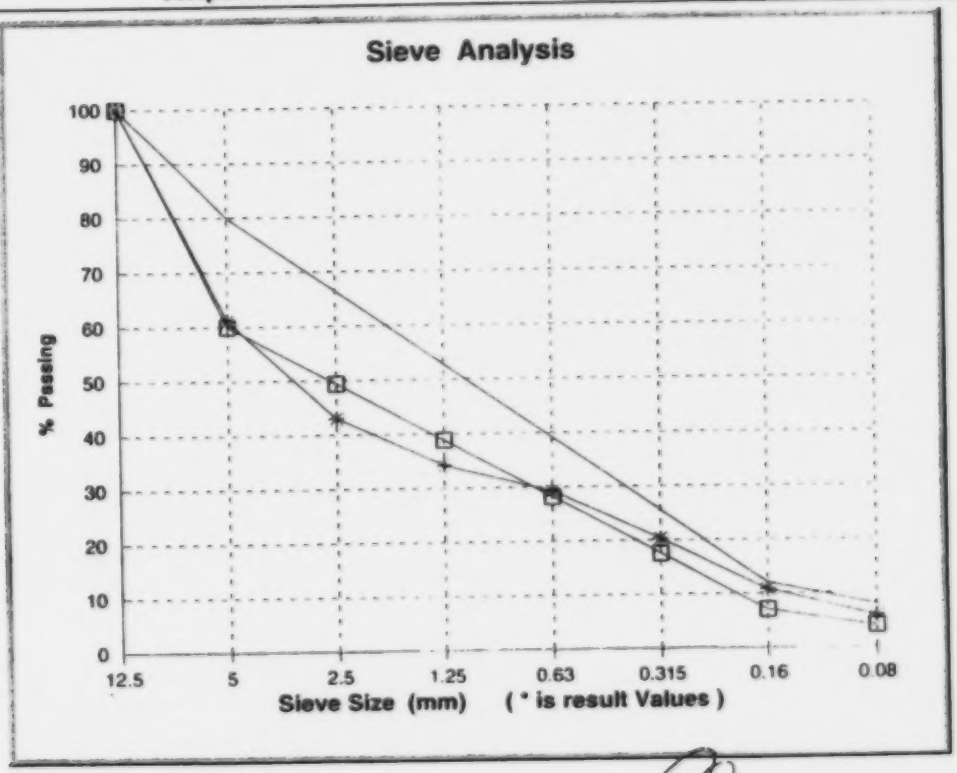
Remarks:

Specific Gravity: 2.335
Theor. Spec. Gravity: 2.431
% Void: 3.9
% Void Filled: 73.7
Stability: 9,975
Flow: 8.5

% Extracted Bitumen: 5.4
% Design Bitumen: 5.6
Film Thickness: 7.5
% Crush: 100.0
Temp. **Field :** 150
Lab : 145
Compaction : 145

	Core	Re-core
Ac Thickness:	55.0	
% Compaction:	97.2	
% Compaction Req:	97.0	

Sieve Size (mm)	% Passing
12.500	100.0
5.000	61.1
2.500	43.0
1.250	34.2
0.630	29.2
0.315	20.3
0.160	10.8
0.080	5.9



TECHNICAL SUPERVISOR

AS-003

ENGINEER

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MARSHALL TEST REPORT

Edmonton
Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

Project ID: 35809

Contract ID: 02PW1

Contract: Recycled Aggregate Test Section - 111 Avenue, 185 Street to Anthony Henday Drive

Sample No: 5 **Contractor:** Standard General Inc.

Sample Date: Sep/07/2002 11:50 AM **Sub Contractor:**

Technician: Darryl Aitchison **Client:** A. Cepas

Asphalt Type: ACO **Department:** Transportation & Streets

Location: Toplift/2nd mat N/S edge/111 Avenue
-7 m E/189 Street

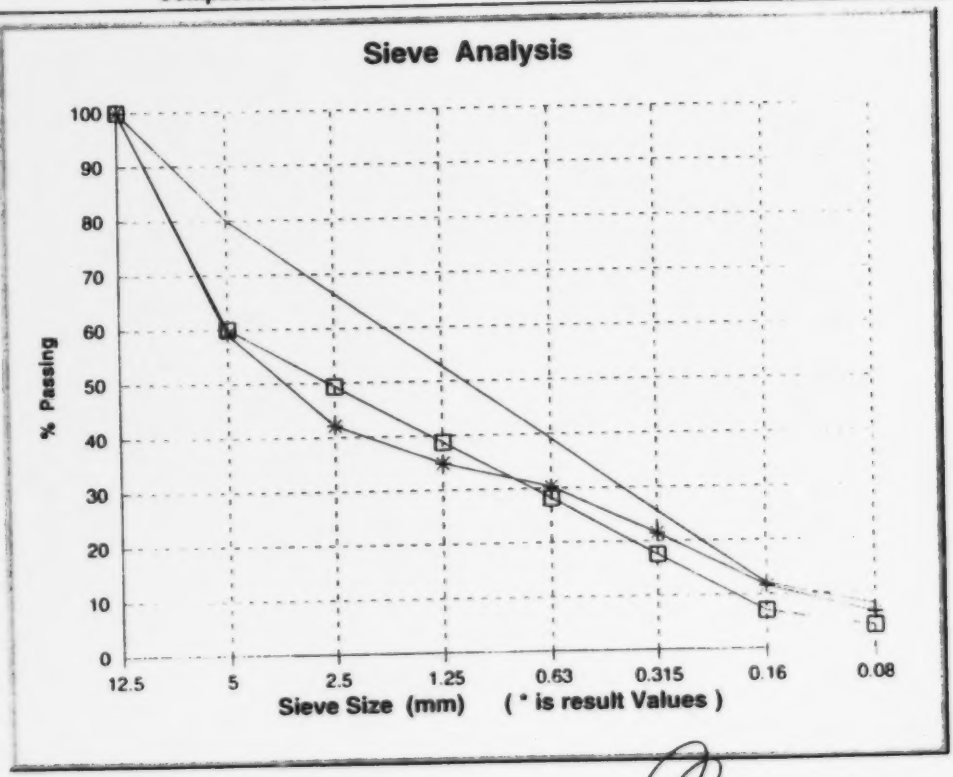
Remarks:

Specific Gravity: 2.342
Theor. Spec. Gravity: 2.440
% Void: 4.0
% Void Filled: 72.5
Stability: 10,926
Flow: 8.1

% Extracted Bitumen: 5.2 (Re extract = 5.2)
% Design Bitumen: 5.6
Film Thickness: 6.8
% Crush: 96.1
Temp. **Field :** 140
Lab : 135
Compaction : 135

	Core	Re-core
Ac Thickness:	63.0	
% Compaction:	98.2	
% Compaction Req:	97.0	

Sieve Size (mm)	% Passing
12.500	100.0
5.000	59.1
2.500	42.2
1.250	34.9
0.630	30.3
0.315	21.5
0.160	11.6
0.080	6.5



TECHNICAL SUPERVISOR

AS-003

ENGINEER

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Edmonton

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

MARSHALL TEST REPORT

Project ID: 35809

Contract ID: 02PW1

Contract: Recycled Aggregate Test Section - 111 Avenue, 185 Street to Anthony Henday Drive

Sample No: 6 **Contractor:** Standard General Inc.

Sample Date: Sep/17/2002 09:30 AM **Sub Contractor:**

Technician: Sheldon Beck **Client:** A. Cepas

Asphalt Type: ACB **Department:** Transportation & Streets

Location: 2nd lift/2ndmat W/E edge/Anthony Henday Drive N Bound offramp to 111 Avenue -100 m S/109 Avenue

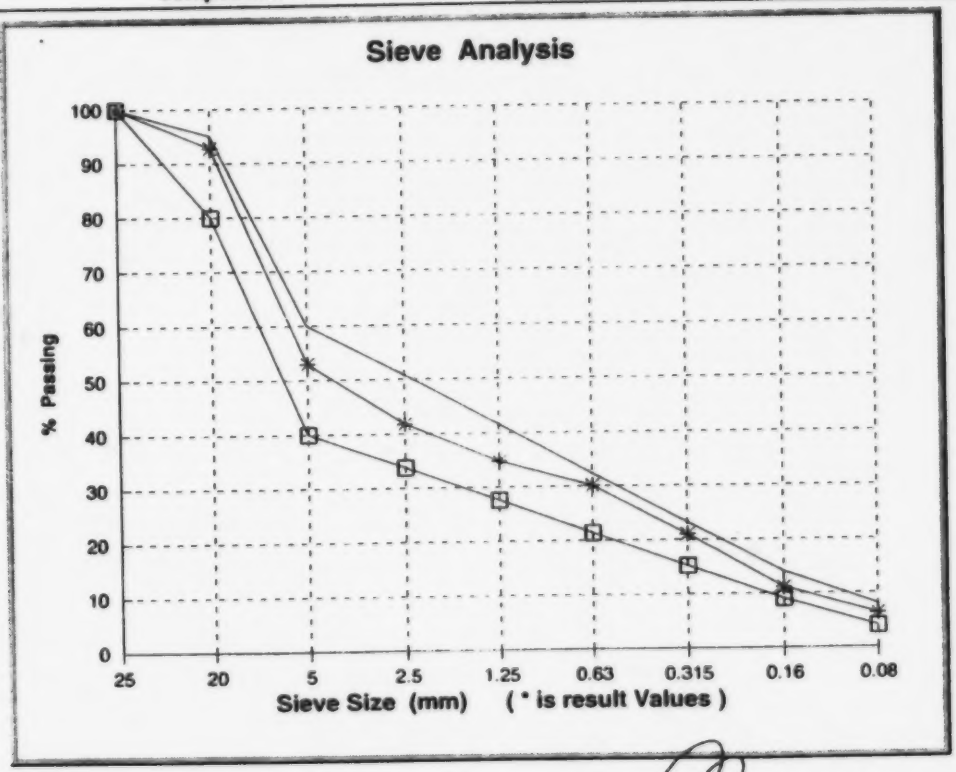
Remarks:

Specific Gravity: 2.380
Theor. Spec. Gravity: 2.464
% Void: 3.4
% Void Filled: 73.1
Stability: 16,406
Flow: 9.5

% Extracted Bitumen: 4.6
% Design Bitumen: 4.9
Film Thickness: 6.0
% Crush: 97.2
Temp. **Field :** 135
Lab : 135
Compaction : 135

	Core	Re-core
Ac Thickness:	90.0	
% Compaction:	99.7	
% Compaction Req:	98.0	

Sieve Size (mm)	% Passing
25.000	100.0
20.000	92.8
5.000	53.0
2.500	41.8
1.250	34.8
0.630	30.1
0.315	21.0
0.160	11.1
0.080	6.3



TECHNICAL SUPERVISOR

AS-003

ENGINEER

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MARSHALL TEST REPORT

Edmonton

Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

Project ID: 35809

Contract ID: 02PW1

Contract: Recycled Aggregate Test Section - 111 Avenue, 185 Street to Anthony Henday Drive

Sample No: 7 **Contractor:** Standard General Inc.

Sample Date: Sep/12/2002 02:30 PM **Sub Contractor:**

Technician: Sheldon Beck **Client:** A. Cepas

Asphalt Type: ACB **Department:** Transportation & Streets

Location: 1st lift/1st mat W/E edge/Anthony Henday Drive N Bound onramp ~300 m N/111 Avenue

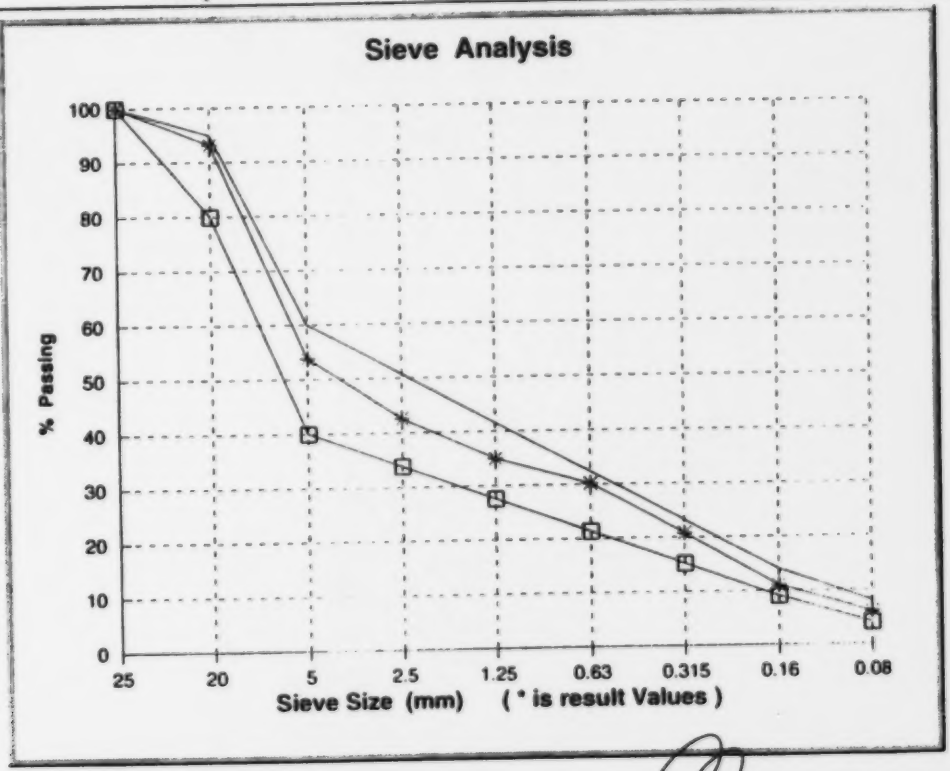
Remarks:

Specific Gravity: 2.365
Theor. Spec. Gravity: 2.462
% Void: 4.0
% Void Filled: 70.3
Stability: 11,274
Flow: 8.9

% Extracted Bitumen: 4.6
% Design Bitumen: 4.9
Film Thickness: 6.2
% Crush: 88.6
Temp. **Field :** 135
Lab : 120
Compaction : 140

	Core	Re-core
Ac Thickness:	65.0	
% Compaction:	99.3	
% Compaction Req:	98.0	

Sieve Size (mm)	% Passing
25.000	100.0
20.000	93.2
5.000	53.8
2.500	42.6
1.250	35.0
0.630	30.2
0.315	20.8
0.160	11.0
0.080	6.0



TECHNICAL SUPERVISOR

ENGINEER

AS 003

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MARSHALL TEST REPORT

Edmonton
Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

Project ID: 35809

Contract ID: 02PW1

Contract: Recycled Aggregate Test Section - 111 Avenue, 185 Street to Anthony Henday Drive

Sample No: 8 **Contractor:** Standard General Inc.

Sample Date: Sep/23/2002 12:30 PM **Sub Contractor:**

Technician: Darryl Aitchison **Client:** A. Cepas

Asphalt Type: ACO **Department:** Transportation & Streets

Location: Toplift/2nd mat E/W edge/111 Avenue offramp ~200 m E/Anthony Henday Drive

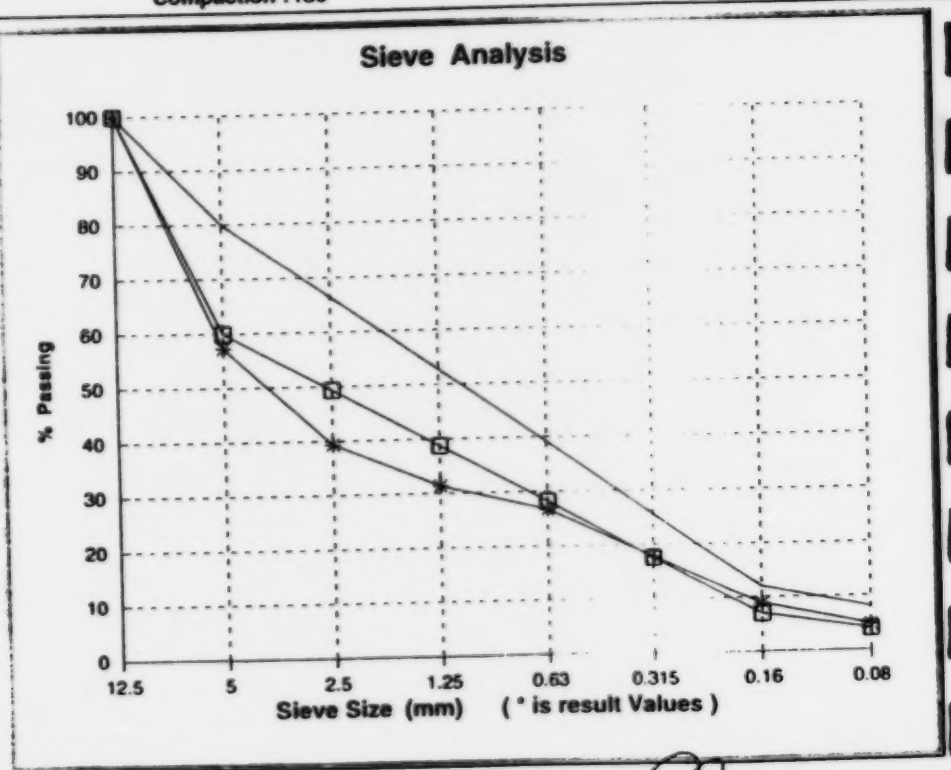
Remarks:

Specific Gravity: 2.324
Theor. Spec. Gravity: 2.446
% Void: 5.0
% Void Filled: 66.7
Stability: 10,511
Flow: 8.3

% Extracted Bitumen: 4.9 (Re extract = 4.9)
% Design Bitumen: 5.6
Film Thickness: 7.8
% Crush: 99.0
Temp. **Field :** 130
Lab : 130
Compaction : 130

	Core	Re-core
Ac Thickness:	53.0	
% Compaction:	97.1	
% Compaction Req:	97.0	

Sieve Size (mm)	% Passing
12.500	100.0
5.000	57.3
2.500	39.4
1.250	31.4
0.630	26.7
0.315	17.8
0.160	8.9
0.080	4.8



TECHNICAL SUPERVISOR

ENGINEER

45-003

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MARSHALL TEST REPORT

Edmonton
Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

Project ID: 35809

Contract ID: 02PW1

Contract: Recycled Aggregate Test Section - 111 Avenue, 185 Street to Anthony Henday Drive

Sample No: 9 **Contractor:** Standard General Inc.

Sample Date: Sep/23/2002 03:33 PM **Sub Contractor:**

Technician: Sheldon Beck **Client:** A. Cepas

Asphalt Type: ACO **Department:** Transportation & Streets

Location: Toplift/1st mat W/E edge/onramp to Anthony Henday Drive N Bound ~100 m N/111 Avenue

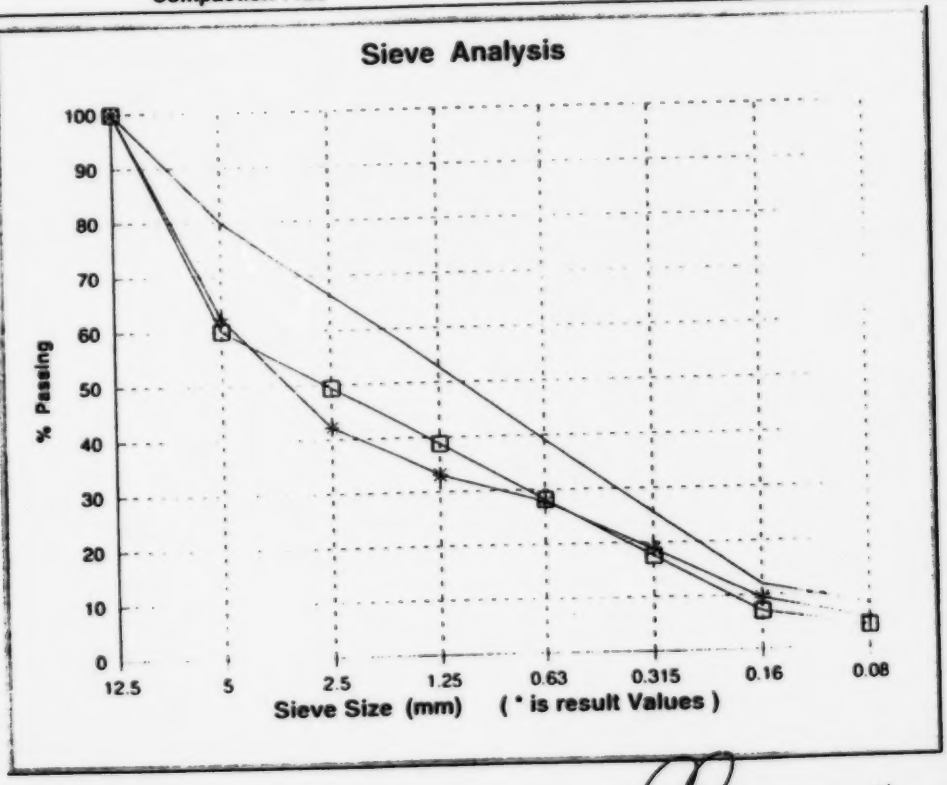
Remarks:

Specific Gravity: 2.309
Theor. Spec. Gravity: 2.432
% Void: 5.1
% Void Filled: 68.1
Stability: 9,231
Flow: 8.7

% Extracted Bitumen: 5.4
% Design Bitumen: 5.6
Film Thickness: 8.0
% Crush: 98.5
Temp. **Field :** 145
Lab : 130
Compaction : 130

	Core	Re-core
Ac Thickness:	55.0	
% Compaction:	100.5	
% Compaction Req:	97.0	

Sieve Size (mm)	% Passing
12.500	100.0
5.000	62.4
2.500	42.2
1.250	33.1
0.630	27.8
0.315	18.8
0.160	9.5
0.080	5.3



TECHNICAL SUPERVISOR

ENGINEER

AS-003

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MARSHALL TEST REPORT

Edmonton
Engineering Services Section
Transportation and Streets
Department
11404 - 60 Avenue

Project ID: 35809

Contract ID: 02PW1

Contract: Recycled Aggregate Test Section - 111 Avenue, 185 Street to Anthony Henday Drive

Sample No: 10 **Contractor:** Standard General Inc.

Sample Date: Sep/24/2002 02:20 PM **Sub Contractor:**

Technician: Dean Upright **Client:** A. Cepas

Asphalt Type: ACO **Department:** Transportation & Streets

Location: Toplift/2nd mat S/N edge/111 Avenue W Bound -60 m W/190 Street

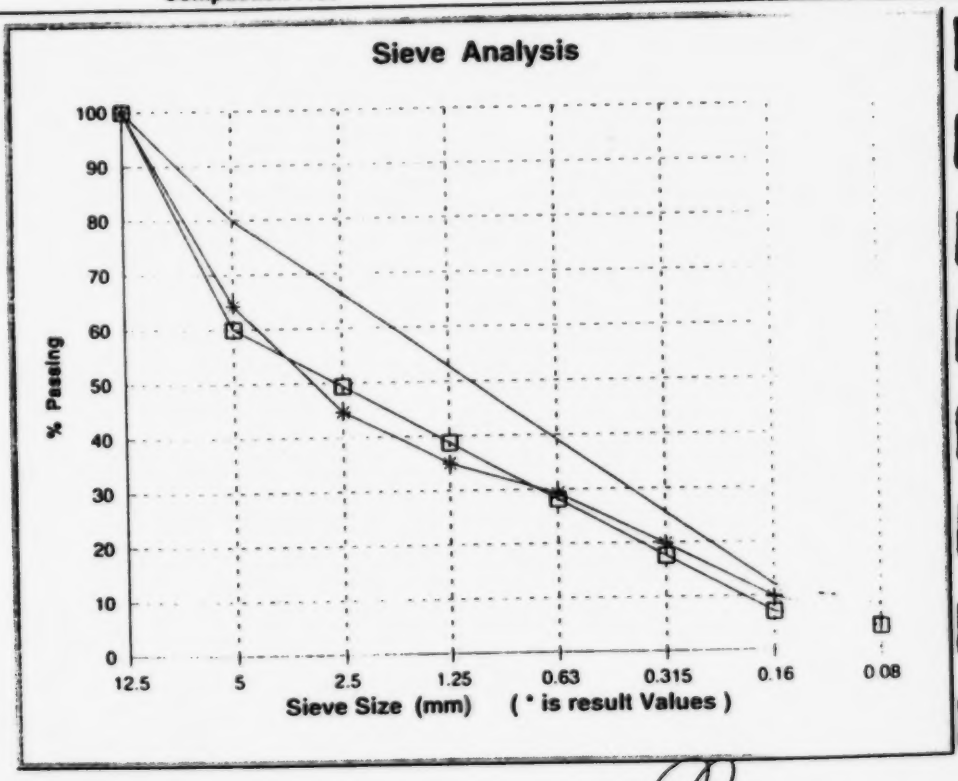
Remarks:

Specific Gravity: 2.320
Theor. Spec. Gravity: 2.434
% Void: 4.7
% Void Filled: 69.8
Stability: 9,187
Flow: 6.9

% Extracted Bitumen: 5.3
% Design Bitumen: 5.6
Film Thickness: 7.8
% Crush: 97.8
Temp. **Field :** 140
Lab : 130
Compaction : 130

	Core	Re-core
Ac Thickness:	58.0	
% Compaction:	97.6	
% Compaction Req:	97.0	

Sieve Size (mm)	% Passing
12.500	100.0
5.000	64.3
2.500	44.7
1.250	35.0
0.630	29.3
0.315	19.8
0.160	9.8
0.080	5.3



TECHNICAL SUPERVISOR

AS-003

ENGINEER

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Edmonton Transportation and Streets Department
Engineering Services

Certified Concrete Testing Laboratory Category II

11404 - 60 Avenue
Edmonton, AB T8E 2G8
496-6787 FAX 944-7653

Concrete Test Report

Sample No: SW - 1 **Contract Id:** 02PW1

Contract: Recycled Aggregate Test Section - 111 Avenue, 185 Street to Anthony Henday Drive

Location: Curb and Gutter
South West corner of 111 Avenue and 186 Street

Client A. Cepas Transportation & Streets

Contractor: Standard General Inc.

Subcontractor:

Cast Date: 2002.08.10 **Dates Tested:** 2002.08.17 2002.09.07 2002.09.07

Test Time	Slump (mm)	Percent Air
10:10	40	5.6

Supplier : Inland Concrete Limited
Mix No.: 30C6201 **Class:** C
Cement Type: 10
Aggregate Size: 20 mm
Slump Ordered: 60 mm
Truck No: 223
Batch Time: 08:58
Ticket No: 2440606
Load Volume: 2.75 m^3
Cumulative Volume: 2.75 m^3

Specified Strength: 30.0 MPa
Specified Slump: 40 - 80 mm
Specified Air: 5.5% and Up
Mix Temperature: 20 °C
Ambient Temperature: 13 °C
Cylinders Cast: 2
Sampling Technician: ML
Water Added at Jobsite?
Before Sampling ☑
After Sampling ☐
Test Status: ***Passed***

Compressive Strength of Concrete

7 Days	28 Days	28 Days
28.3 **MPa**	40.1 **MPa**	39.4 **MPa**

Remarks:
At 9:40 slump 30mm. 10 litres of water added by Inland driver.
Retest taken at 10:10

Engineer / Supervisor

Unit Supervisor

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Edmonton Transportation and Streets Department
Engineering Services

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Edmonton, AB T8E 2G8
496-6787 FAX 944-7653

Certified
Concrete Testing Laboratory
Category II

Concrete Test Report

Sample No: SW - 2 **Contract Id:** 02PW1

Contract: Recycled Aggregate Test Section - 111 Avenue, 185 Street to Anthony Henday Drive

Location: Center Meridian (east end, first 20 meters),
Centerline of 111 Avenue,
80 meters east of 186 Street.

Client A. Cepas Transportation & Streets

Contractor: Standard General Inc.

Subcontractor:

Cast Date: 2002.09.16 **Dates Tested:** 2002.09.23

Test Time	Slump (mm)	Percent Air
14:30	65	7.4

Supplier : Inland Concrete Limited
Mix No.: 30C6201 **Class:** C
Cement Type: 10
Aggregate Size: 20 mm
Slump Ordered: 70 mm
Truck No: 418
Batch Time: 13:15
Ticket No: 2442721
Load Volume: 5.5 m^3
Cumulative Volume: 5.5 m^3

Specified Strength: 27.2 MPa
Specified Slump: 40 - 80 mm
Specified Air: 5.5% and Up
Mix Temperature: 20 °C
Ambient Temperature: 17 °C
Cylinders Cast: 3
Sampling Technician: ML
Water Added at Jobsite?
Before Sampling ☐
After Sampling ☐
Test Status:

Compressive Strength of Concrete

7 Days		
24.7 MPa		

Remarks:

Engineer / Supervisor

Unit Supervisor

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Edmonton Transportation and Streets Department
Engineering Services

11404 - 60 Avenue
Edmonton, AB T8E 2G8
496-6787 FAX 944-7653

Certified Concrete Testing Laboratory Category II

Concrete Test Report

Sample No: SW - 3 **Contract Id:** 02PW1

Contract: Recycled Aggregate Test Section - 111 Avenue, 185 Street to Anthony Henday Drive

Location: Walk (first 5 meters), Northwest corner of 184 Street and 111 Avenue.

Client A. Cepas Transportation & Streets

Contractor: Standard General Inc.

Subcontractor:

Cast Date: 2002.09.17 **Dates Tested:** 2002.09.24

Test Time	Slump (mm)	Percent Air
16:05	65	8.2

Supplier : Inland Concrete Limited
Mix No.: 30C6201 **Class:** C
Cement Type: 10
Aggregate Size: 20 mm
Slump Ordered: 70 mm
Truck No: 236
Batch Time: 15:17
Ticket No: 2442832
Load Volume: 7.5 m^3
Cumulative Volume: 7.5 m^3

Specified Strength: 26.0 MPa
Specified Slump: 40 - 80 mm
Specified Air: 5.5% and Up
Mix Temperature: 21 °C
Ambient Temperature: 15 °C
Cylinders Cast: 3
Sampling Technician: ML
Water Added at Jobsite?
Before Sampling ☐
After Sampling ☐
Test Status:

Compressive Strength of Concrete

7 Days		
22.5 MPa		

Remarks:

Engineer / Supervisor

Unit Supervisor

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Edmonton Transportation and Streets Department
Engineering Services

11404 - 60 Avenue
Edmonton, AB T8E 2G8
496-6787 FAX 944-7653

CSA Concrete Testing Laboratory
Category II

Concrete Test Report

Contract Id: 02PW1

Sample No: SW - 4

Contract: Recycled Aggregate Test Section - 111 Avenue, 185 Street to Anthony Henday Drive

Location: Extruded Walk,
South side of 111 Avenue,
50 meters east of 190 Street.

Client A. Cepas Transportation & Streets

Contractor: Standard General Inc.

Subcontractor:

Cast Date: 2002.09.21 **Dates Tested:** 2002.09.28

Test Time	Slump (mm)	Percent Air
07:32	25	6.5

Supplier : Inland Concrete Limited
Mix No.: 3016201 **Class:** C
Cement Type: 10
Aggregate Size: 20 mm
Slump Ordered: 30 mm
Truck No: 102
Batch Time: 06:57
Ticket No: 2443096
Load Volume: 7 m^3
Cumulative Volume: 7 m^3

Specified Strength: 29.0 MPa
Specified Slump: 20 - 40 mm
Specified Air: 5.5% and Up
Mix Temperature: 17 °C
Ambient Temperature: 9 °C
Cylinders Cast: 3
Sampling Technician: BW
Water Added at Jobsite?
Before Sampling
After Sampling
Test Status:

Compressive Strength of Concrete

7 Days		
27.9 MPa		

Remarks:

Engineer / Supervisor

Unit Supervisor

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Edmonton Transportation and Streets Department
Engineering Services

Concrete Testing Laboratory
Category II

11404 - 60 Avenue
Edmonton, AB T8E 2G8
496-6787 FAX 944-7653

Concrete Test Report

Contract Id: 02PW1

Sample No: SW - 5

Contract: Recycled Aggregate Test Section - 111 Avenue, 185 Street to Anthony Henday Drive

Location: Walkway,
North side of 111 Avenue,
5 meters west of fourth light pole,
West of 186 Street.

Client A. Cepas Transportation & Streets

Contractor: Standard General Inc.

Subcontractor:

Cast Date: 2002.09.21 **Dates Tested:** 2002.09.28

Test Time	Slump (mm)	Percent Air
12:25	20	7.4

Supplier : Inland Concrete Limited
Mix No.: 3016201 **Class:** C
Cement Type: 10
Aggregate Size: 20 mm
Slump Ordered: 30 mm
Truck No: 418
Batch Time: 11:45
Ticket No: 2443136
Load Volume: 5.5 m^3
Cumulative Volume: 102 m^3

Specified Strength: 27.2 MPa
Specified Slump: 20 - 40 mm
Specified Air: 5.5% and Up
Mix Temperature: 14 °C
Ambient Temperature: 10 °C
Cylinders Cast: 3
Sampling Technician: KM
Water Added at Jobsite?
Before Sampling ☐
After Sampling ☐
Test Status:

Compressive Strength of Concrete

7 Days		
28.2 MPa		

Remarks:

Engineer / Supervisor

Unit Supervisor

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THE CITY OF Edmonton

Engineering Services Section
Transportion and Streets Department
11404 - 60 Avenue T6J 1J5

Summary of Concrete Compressive Strength Results

Contract Id: 02PW1 Contract Code: SW

Recycled Aggregate Test Section - 111 Avenue, 185 Street to Anthony Henday Drive

Date Printed: Wednesday September 25, 2002

Contractor: **Standard General Inc.**
Customer: **Pavement Management**
Client: **A. Cepas** Dept: **66 - Transportation & Streets**
Supplier: **Inland Concrete Limited**
Mix: **30C6201** **Roadways Exposed Summer Hand Pour**
Strength: **Varies by % Air ***
Type: **10** Class: **C** Days: **28**

Sample #		Cast Date	Cast Time	Ticket #	Mix Temp.	Slump (mm)	% air	Minimum Strength		Strength (MPa) 7 Day	28 Day	28 Day	28 Day Avg
SW	1	2002/08/10	1010	2440606	20	40	5.6	30.0	*	28.3	40.1	39.4	39.8
SW	2	2002/09/16	1430	2442721	20	65	7.4	27.2	*	24.7			
SW	3	2002/09/17	1605	2442832	21	65	8.2	26.0	*	22.5			

28 Day Compressive Strength (MPa)

High	Low	Mean
39.8	39.8	39.8

Number of Completed Tests: 1
Standard Deviation: 0 MPa.
Coefficient of Variation: 0 (%)

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THE CITY OF Edmonton

Engineering Services Section
Transportion and Streets Department
11404 - 60 Avenue T6J 1J5

Summary of Concrete Compressive Strength Results

Contract Id: 02PW1 Contract Code: SW

Recycled Aggregate Test Section - 111 Avenue, 185 Street to Anthony Henday Drive

Date Printed: Wednesday September 25, 2002

Contractor: **Standard General Inc.**
Customer: **Pavement Management**
Client: **A. Capas** Dept: **66 - Transportation & Streets**
Supplier: **Inland Concrete Limited**
Mix: **3016201** **Roadways SummerExposed Extrusion**
Strength: **Varies by % Air** *
Type: **10** Class: **C** Days: **28**

Sample #		Cast Date	Cast Time	Ticket #	Mix Temp.	Slump (mm)	% air	Minimum Strength	Strength (MPa) 7 Day	28 Day	28 Day Avg
SW	4	2002/09/21	0732	2443096	17	25	6.5	29.0 *			
SW	5	2002/09/21	1225	2443136	14	20	7.4	27.2 *			

28 Day Compressive Strength (MPa)

High	Low	Mean
0.0	0.0	0.0

Number of Completed Tests: **0**
Standard Deviation: **0 MPa.**
Coefficient of Variation: **0 (%)**

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Edmonton Transportation and Streets Department
Engineering Services

CSA Concrete Testing Laboratory
Category II

11404 - 60 Avenue
Edmonton, AB T8E 2G8
496-6787 FAX 944-7653

Concrete Test Report

Contract Id: 02PW1

Sample No: SW - 6

Contract: Recycled Aggregate Test Section - 111 Avenue, 185 Street to Anthony Henday Drive

Location: Walkway,
Southwest corner of 111 Avenue, second street west of 186 Street (188 Street),
2 meter portion attached to curb ramp.

Client A. Cepas Transportation & Streets

Contractor: Standard General Inc.

Subcontractor:

Cast Date: 2002.09.23 **Dates Tested:** 2002.09.30

Test Time	Slump (mm)	Percent Air
07:36	75	6.6

Supplier : Inland Concrete Limited
Mix No.: 30C6201 **Class:** C
Cement Type: 10
Aggregate Size: 20 mm
Slump Ordered: 70 mm
Truck No: 224
Batch Time: 06:52
Ticket No: 2443212
Load Volume: 5.5 m^3
Cumulative Volume: 5.5 m^3

Specified Strength: 28.8 MPa
Specified Slump: 40 - 80 mm
Specified Air: 5.5% and Up
Mix Temperature: 17 °C
Ambient Temperature: -2 °C
Cylinders Cast: 3
Sampling Technician: GL
Water Added at Jobsite?
Before Sampling [ ]
After Sampling [ ]
Test Status:

Compressive Strength of Concrete

7 Days		
23.1 MPa		

Remarks:

Engineer / Supervisor

Unit Supervisor

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